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THE PHENOMENA OF ACIDOSIS AND ITS DOMINATING INFLUENCE IN SURGERY*

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LIFE is incompatible with acidity, for not only animal but plant life as well demands for its continuance an alkaline or at least a neutral medium. When soil becomes acid it must be "fertilized" by the addition of alkalies, or it becomes sterile. Water plants cannot grow in acidulated water, and if the alkalinity of the blood in animals be even slightly diminished life ceases.

It is, however, by the breaking down of alkalies and bases that energy is produced for muscular action and heat, that is, for the phenomena of life itself, and the breaking down of alkalies and bases is invariably attended by the formation of acid by-products. If the soil, the sea and the blood must be alkaline in order to support life, and if the activities of life are constantly producing acids, by what means are the acid by-products of energy transformation neutralized? The acidity of the soil is removed by man by the addition of fertilizing mixtures; the plants rid themselves of their acid by-products by diffusion into the soil through their roots; for man, however, a special mechanism of neutralization and elimination is required.

On *a priori* grounds one would expect that part of the mechanism evolved in the human body for the elimination of acids would be adapted to eliminate the gaseous acids and another to eliminate the acids in solution.

The elimination of gaseous acid, CO_2 , is obviously principally accomplished by the lungs. The maximum ventilation of the lungs is attained by rapid and deep respiration; by wide dilatation of the nostrils, the bronchioles and the air vesicles. Dilatation of the *alæ nasi*, of the bronchioles and of the air vesicles is governed by adrenin, while the rate and amplitude of respiration is under the control of the respiratory

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centre in the medulla. An increase of CO_2 in the body must therefore cause an increased output of adrenin, and must increase the activity of the respiratory centre.

Magnus, Elliott, Cannon and myself have shown that exertion, emotion, injury, infection, auto-intoxication, Graves' disease, strychnine convulsions, injections of indol and skatol, of amino-acids, of foreign proteins, of placental extract—in fact all the activators of the mechanism for energy transformation, cause an increased output of adrenin. We have shown also that all these activators cause increased acid by-products, both gaseous and in solution. The adrenals are controlled by the brain, and when the connection between the brain and the adrenals is severed, or when the function of the brain is depressed or suspended by morphia, then activation of the adrenals causes no increased output of adrenin. Physiologists are now agreed that the H-ion concentration of the blood governs the respiratory centre.

These facts show that the mechanism for the elimination of the gaseous part of the acid by-products of energy transformation—metabolism—consists of the brain, the adrenals and the lungs. That is, the presence of carbon dioxide in the blood stimulates the centres of the brain which govern the rate and the amplitude of respiration and that which governs the output of adrenin. Therefore, the injection of CO_2 in a normal individual should cause increased adrenin output and increased respiration—and by experiment we have proved that it does so. The injection of carbon dioxide alone causes no other symptoms.

It is of immense significance that the vital function of the respiratory centre is controlled by the H-ion concentration of the blood. The mere fact that the H-ion concentration rather than oxygen controls the respiratory centre shows, in fact, that the life of animals is more endangered by increased acidity than by decreased supply of oxygen.

The final points of exit from the body for the acid by-products which are in solution in different body fluids are the kidney tubules and the sweat-glands. The acid by-products of energy transformation when first formed, however, are not in a chemical form suitable for elimination by the kidneys or the skin, but must first be transformed into harmless salts, such as phosphates, sulphates, chlorides, urea, creatin, and creatinin. In these forms acids may be eliminated without harming the kidneys.

It is necessary, therefore, to discover where the chemical substance or substances which transform the harmful acid by-products of metabolism into harmless acid salts are stored; what mechanism regulates

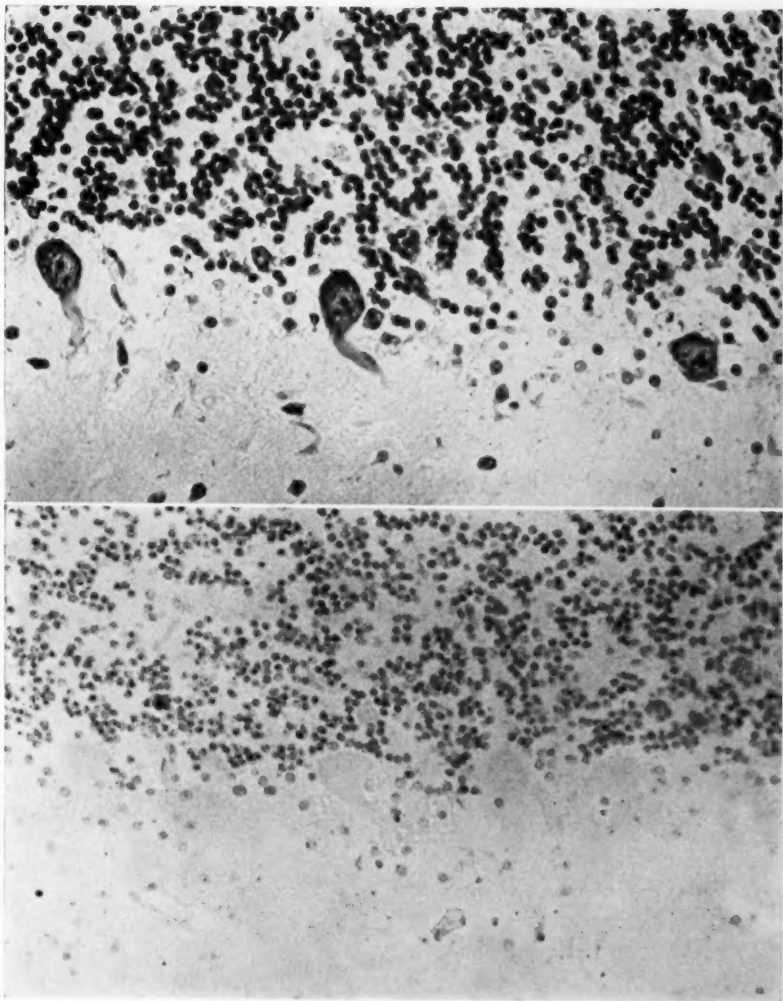


FIG. 1.—*A*, Section of human cerebellum—normal ($\times 310$). *B*, Section of human cerebellum showing effect of acidosis ($\times 310$). There are no active cells present, but faint traces of the Purkinje cells are visible.

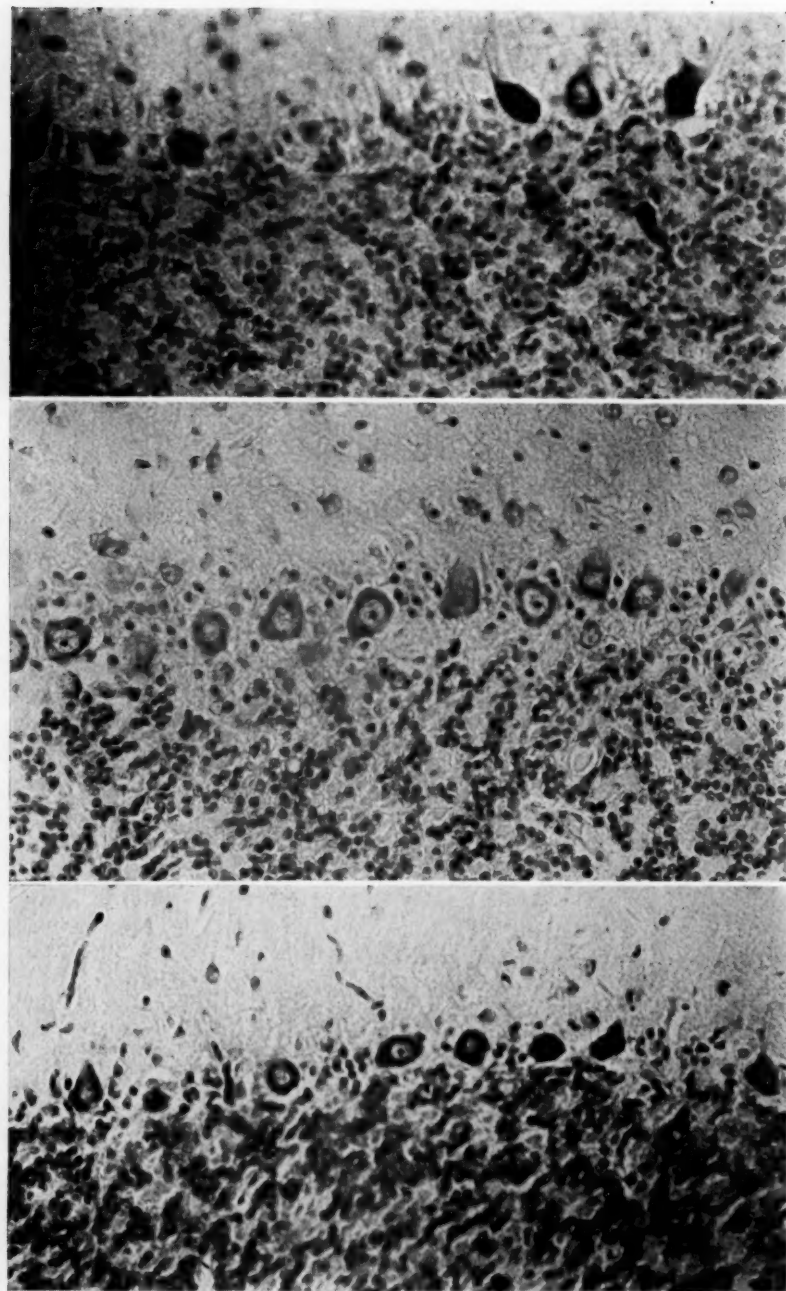


FIG. 2.—A, Section of cerebellum of cat—normal ($\times 310$). B, Section of cerebellum of cat showing effect of injection of acid sodium phosphate ($\times 310$). Compare the destructive effect of the acid with the protective effect of the alkali in C. C, Section of cerebellum of cat showing effect of injections of sodium bicarbonate ($\times 310$).

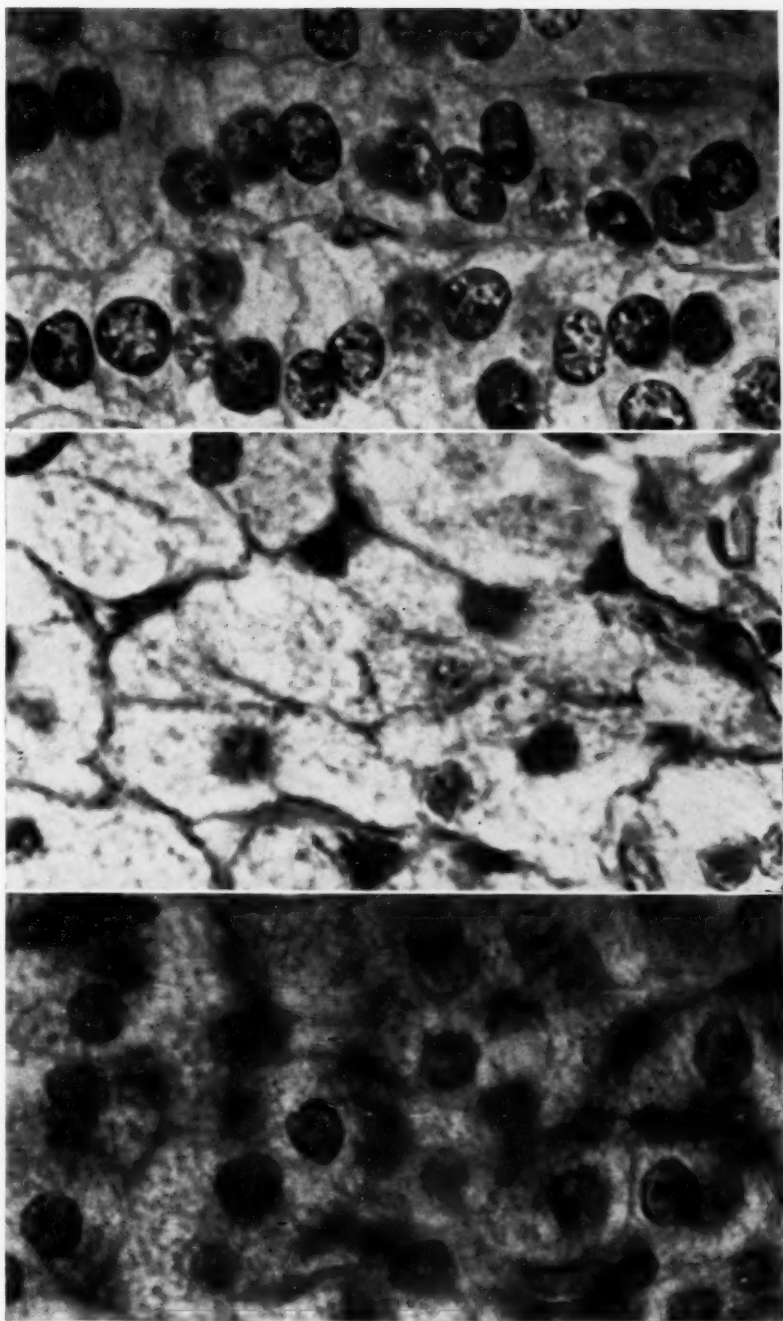


Fig. 3.—*A*, Section of normal adrenal of cat ($\times 1640$). *B*, Section of adrenal of cat showing effect of injection of acid sodium phosphate ($\times 1640$). Note the disappearance of cell substance, the misshapen cells and eccentric nuclei. *C*, Section of adrenal of cat showing effect of injection of sodium bicarbonate ($\times 1640$). Compare the protective effect of the alkali with the destructive effect of the acid in *B*.

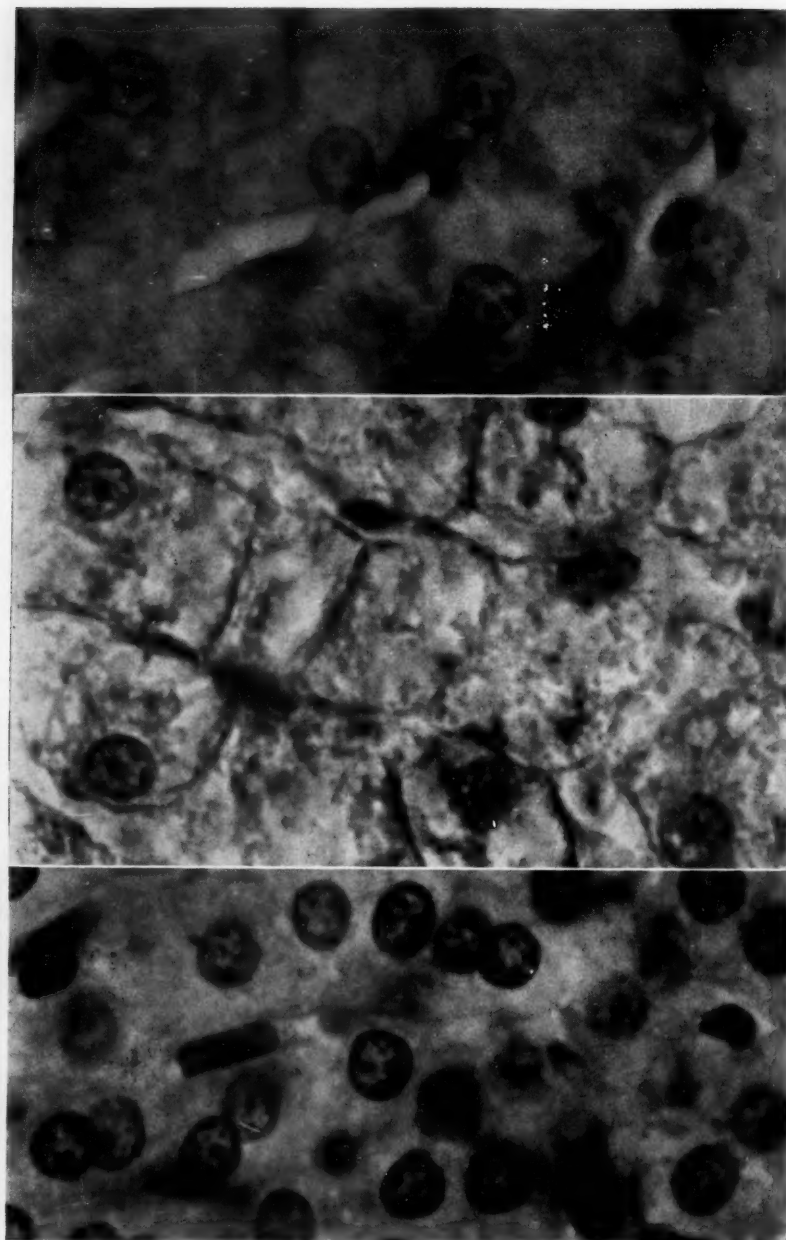


FIG. 4.—A, Section of liver of cat—normal (x 1640). B, Section of liver of cat showing effect of injections of acid sodium phosphate (x 1640). Note the general disappearance of cell substance and the vacuolated spaces. C, Section of liver of cat showing effect of injections of sodium bicarbonate (x 1640). Note the protective effect of the alkali as compared with the destructive effect of the acid in B.

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the supply of these substances; and whether the stimulus that activates the mechanism by which energy is transformed into muscular action simultaneously activates the mechanism by which the acid by-products resulting from energy transformation are neutralized or transformed.

In my laboratory we have endeavored to answer these questions both by chemical and by histologic studies. Examinations of all the organs and tissues of the body after the application of every kind of kinetic stimulus showed histologic changes—disappearance of chromatin and changes in the size and shape of the cells—in the brain, the adrenals and the liver, and in these organs only. Moreover, the injection of an acid, such as acid sodium phosphate or hydrochloric acid, caused identical lesions, while the injection of an alkali—sodium bicarbonate—caused no histologic changes in the brain, the adrenals and the liver excepting to increase their stainability. Chemical studies showed a diminished percentage of glycogen in the muscles after the application of kinetic stimuli, and consistent changes in the iodine content of the thyroid and of the glycogen content of the liver as well. Our chemical studies showed further that all the fluids in the body excepting the urine are alkaline and that the blood, the spinal fluid and the bile are persistently alkaline, and that the *potential alkalinity* of each is great, that is, that each has a high power of acid neutralization.

For the further identification of the organs governing acid neutralization studies of the H-ion concentration of the blood were made after the excision of different organs. The excision of the pancreas, of the spleen, of the thymus, of the thyroid, of the testicles, of the ovaries, of portions of the intestines, of the stomach and of the brain caused no change in the H-ion concentration of the blood; but the excision of the adrenals or of the liver was followed by increased H-ion concentration before death.

That is, in from four to eighteen hours after excision of the adrenals the alkalinity of the blood began to decrease, and coincidentally with this decrease in alkalinity began the rapid decline of the animal. Excision of the liver was followed by death in from a few to sixteen hours, and just before death the H-ion concentration of the blood rapidly increased. Histologic studies of the organs of these animals showed, in the case of the animals which had undergone adrenalectomy, a marked deterioration of the cells of the brain and the liver, and in the animals whose livers had been removed the brain and the adrenals showed extensive histologic changes.

All of these studies determine that the brain, the adrenals, the liver, the thyroid and the muscles together play important parts in energy

transformation, and that at least three of these organs, the brain, the adrenals and the liver, are especially concerned also in the neutralization of the acids resulting from energy transformation.

What is the function of the brain in acid neutralization? The evidence already given suggests that its part is to govern the mechanism by whose action the actual neutralization is accomplished. The following experimental observations further establish this fact. When the H-ion concentration of the blood of an animal had been increased to the point of actual acidity even—by emotion, exertion, or anæsthesia—and the animal was then deeply morphinized, it was found that the blood did not return to its normal alkalinity, that is, the body had lost the power to neutralize acidity. The clinic also has confirmed the fact that heavy morphinization hinders or even inhibits the neutralization of increased acidity caused by anæsthesia.

In addition a decapitated animal in which the H-ion concentration had been increased by anæsthesia or by strychnine convulsions showed but slight power of overcoming the acidity.

We conclude, therefore, that the brain performs a dual kinetic function—its driving power is the principal cause of the transformation of energy, and it has also evolved within itself a mechanism for the neutralization of the acid products of energy transformation.

In addition to the active functions of the brain, the adrenals and the liver in acid neutralization, the body fluids have an inherent form of neutralization independent of the brain.

If after excision of the brain the H-ion concentration of the blood is increased and adrenin administered, the neutralizing power of the body will be increased. If the liver as well as the brain be removed, however, the neutralizing power of adrenin will be lost.

If our conclusions be well founded, they provide us with the key to the causation of certain conditions and to the interpretation of certain clinical phenomena. For example, if in a certain case there is shown a continuous increase of acid by-products for the neutralization of which an unusual amount of alkali is required, then we may presume that the liver, the adrenals and the brain are undergoing abnormal changes; and that unless the acid condition be altered, these structural changes in the brain, the adrenals and the liver will become permanent and certain of the chronic diseases will result.

For the practical application of this study in my laboratory we are now measuring the acidity of the urine, blood, cerebrospinal fluid and bile by means of indicators—using with some modifications the methods of Sørensen, Henderson and others. In the case of urine and cerebro-

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spinal fluid the indicators may be directly applied—the method being made applicable to blood by rapid dialysis by Rowntree's method.

We employ two indicators: (1) sodium alizarin sulphonate (2 per cent. solution) and (2) phenolsulphonephthalein (0.6 per cent. solution). This gives a wide range of H-ion concentrations varying from $P_H = 8.7$ on the alkaline side to $P_H = 4.57$ at the acid end of the scale, the neutral point being $P_H = 7.0$.

(It is customary to express H-ion concentrations in the way suggested by Sørensen, by the logarithm of the H-ion normal with the negative sign omitted—this being indicated by the symbol P_H .)

For making up the scale of standard solutions four stock solutions of known H-ion concentration are prepared:

- (a) Sodium acetate27.2 gms. per litre.
- (b) Acetic acid27.2 gms. per litre.
- (c) Disodium phosphate17.8 gms. per litre.
- (d) Monopotassium phosphate13.6 gms. per litre.

To make up the standard solutions from which the color scale is made, these stock solutions are mixed in varying proportions to yield solutions of the desired H-ion concentrations. For example:

20 c.c. stock solution (a) + 30 c.c. stock solution (b)
+ 250 c.c. distilled water = A solution, $P_H = 4.57$

The scale is made up by placing about 5 c.c. of each of the standard solutions plus one drop of each of the indicators in an equal number of hand-glass test-tubes of uniform size, then diluting the contents of each tube to about 15 c.c.

The H-ion concentration of any fluid may be quickly found; therefore, by placing about 2–3 c.c. of that fluid in a clean test-tube, adding a drop of each of the indicators, diluting the contents to about 15 c.c. and finding the solution in the scale which most closely matches it in color. The known H-ion concentration of that solution will be the H-ion concentration required.

For the dialysis of blood and of turbid urine collodion membranes are made. The solution to be dialyzed is placed in one of these membranes which is then lowered into a short tube containing normal saline solution at body temperature. This is kept at 37° C. for a few minutes, the dialysate poured off and the H-ion determination made after cooling to room temperature.

This in brief indicates the method by which we are securing new light upon clinical problems.

We can sometimes foresee an impending acidosis. We can check

up the results of operative procedures. We can see the trend of a case in which a condition of mild acidosis already exists, and may discover means by which to ameliorate the physical changes which are caused by or are incident to the presence in the system of abnormal amounts of acid. These observations explain also the reason for what has long proved an advantage in these cases—the use of sodium bicarbonate, and the ingestion of large quantities of water. Just as the acid soil needs water, so does the acid animal body need water.

Whenever there is increased acidity in the body there is thirst. When one exercises he is thirsty; as he is also if he has a fever or is in emotional stress. Anæsthesia is followed by thirst, and we have proved that anæsthesia always produces acidity. Acidosis is accompanied by sweating. Sweating is nature's attempt to aid the kidneys and the lungs in their effort to eliminate acids. An increase in pulse-rate is another phenomenon of acidosis and we have already discussed the function of the increased respiratory rate caused by increased H-ion concentration.

We see, therefore, that the principal phenomena of many normal processes and of many disease processes are due to the activation of the mechanism in the body by which acids are eliminated.

Consider, for instance, the phenomena of ordinary fever, or of infection of any kind. The prominent characteristic clinical phenomena in any case are due to the effort of the body to maintain the normal alkalinity of the blood. The same thing is true of exophthalmic goitre. Indeed in fatal cases of this intensely kinetic disease the common cause of death is acidosis. The so-called post-operative hyperthyroidism is chiefly acute acidosis.

In the cycles of exophthalmic goitre there are periods of vomiting, of acid breath, of restlessness, of rapid heart action, and of rapid respiration—all characteristic phenomena of acidosis.

The acidosis of surgical shock and of Graves' disease on the other hand is the result of the kinetic driving of the entire system to such an extent that an undue strain is put upon all the organs of elimination. This is the explanation also of the acidosis which results from overwork or from excessive physical exertion. For the same reason also great emotion may produce an acute acidosis. As a result of the strain put upon all the organs of elimination by the general activations, some one—the weakest—may break under the strain and a chronic acidosis will result.

Another interesting and significant fact, proved by experiments in collaboration with Dr. M. L. Menten, is that nitrous oxide, ether, and

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chloroform during their administration all produce increased acidity of the blood. In our experiments we have found out recently the additional fact that the acidity of the urine is increased markedly under ether and chloroform—less under nitrous oxide. This finding has a most important significance for the surgeon, as it explains why the administration of the anæsthetic to a starved patient with gastric or duodenal ulcer, for example, may cause death by precipitating the impending acidosis. That acidosis does impend in these cases is well known, and our experiments have shown an increased acidity of the urine of starving dogs.

In view of these observations and generalizations, imperfectly sketched as they have been, we may well conclude that in greater or less degree acidosis is present in every abnormal condition of the body whose origin can be traced to excessive kinetic activations from any cause, and that the maintenance of the normal potential alkalinity of the body is of vast clinical importance. The factors increasing acid by-products—emotion, operative trauma, inhalation anæsthesia, starvation, infection—should as far as possible be controlled by the surgeon. The *anociated* operation minimizes these injuring factors, but the patient should also be protected in advance of operation by giving water, glucose, and sodium bicarbonate, and the post-operative state also may be improved and convalescence hastened by these measures.

A REVIEW OF THE LITERATURE OF FRACTURES*

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THE task assigned to me has proven most difficult from the purely statistical stand-point.

With few exceptions, surgeons have neglected to perfect their records upon the following essential points, viz.: exact description of initial lesion; period of hospital residence; time interval between injury and resumption of work; degree of permanent deformity and loss of function.

As a rule, favorite methods of treatment have found justification when union has taken place and the patient has been discharged. Later and most essential details are rarely available. I am of the opinion that the real merit of various methods and policies must await final adjudication, until a very large number of fractures have been observed for a period of from one to three years. This will involve an outlay of time and effort as will rarely be incurred by individuals, and such investigation can only be efficiently carried out by social service organizations which command the time of men specially qualified for critical analysis.

Furthermore, we are confronted by this vital consideration, that in each individual fracture, its mechanism and primary status are widely variable factors as influencing end results, or determining the value of a particular method of treatment. The designation "fracture of the humerus," "forearm," "femur," or "leg," in the tabulation of a series of fractures is vague and indeterminate, in the absence of full details as to the peculiar features of each fracture.

Similar comment applies to the classification "open," "closed," "comminuted," and "joint fracture," and deductions from indiscriminate classification are inherently misleading and of little scientific value.

"All surgeons," says John B. Walker,¹ "must admit the necessity of collecting data for future guidance in giving the best prognosis and treatment. But it is possible to make this material of value *only* by carefully classifying and correctly collecting large numbers of cases, so that we can find the normal average duration of disability which is our best guide for treatment in a given type of case. In our previous attempts to do this, we have become more and more dissatisfied with

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present statistics, for our judgment tells us that the majority of statistics are incorrect."

Dr. Chas. G. Levison, of San Francisco, in a personal communication says: "After going over my fracture histories I am unable satisfactorily to furnish data as to hospital residence, period of convalescence and degree of impaired function. This is usual in hospitals which have not developed the social service system."

Since the foregoing was written, Dr. Harold Brunn, of San Francisco, in a personal communication, makes the following confirmatory comment: "I have attempted to follow your scheme in the analysis of a series of 63 fractures occurring in the City and County Hospital of San Francisco, and I find this to be impossible without giving an erroneous impression of our statistics, for the following reasons:

"First, histories are frequently incomplete, and essential data are wanting. Second, the class of cases we have dealt with are, frequently, old and arthritic, or suffering from a complication of diseases. Third, our patients, usually, are without means or refuge, and their hospital residence is prolonged unduly and measured by their ability to perform manual labor after dismissal.

"I feel, also, that every fracture, even of the same part, varies so much in character, that conclusions of value cannot be deduced."

It is an aphorism that nearly every fracture embodies a potential loss of function and deformity. Consequently, it is fundamental that analyses of end results, as related to types of fracture or special methods of treatment, must reckon not only with the bone or bones involved, but with the peculiar mechanism of small groups of each type. This involves a study of the following collateral data:

(1) The personal equation of the patient; age, social and physical condition.

(2) The bone lesion, whether single or multiple, relation to joint structures, direction of fracture lines, and coexisting comminutions.

(3) Trauma of soft parts, skin muscles, blood-vessels and nerve trunks.

(4) The special method used and, in operative cases, the fixation material employed.

For the above reasons, after referring to various phases of fracture treatment as set forth by leading authorities, I shall, briefly, review the work upon which opinions are predicated.

Revival of interest in this department of surgery, in recent years, has led to a keen appreciation of the tremendous importance of the subject. Surgeons realize that conventional methods of whatever type

do not satisfy the exactions of the patient or the courts. Each step in the development of the subject has suggested new and interesting problems in the associated sciences, biology, mechanics, economics, and sociology. Each of these interests has challenged consideration, and each has stimulated human endeavor.

Mankind has learned to think in similar terms, and has arrived at a finer sense of proportion. Precision has become the genius of performance, and values are expressed not in vague generalities, but in equations. Indifferent and arbitrary standards are no longer accepted as a yardstick, nor do they serve as a refuge. "Bony union," once the surgeon's shibboleth, in the presence of obvious defects, such as discomfort, lowered efficiency or loss of function, is no longer an achievement. Briefly, clinical and sociological results must be closely correlated.

The Bloodless Method in Fracture Treatment.—Conservatism, in this relation, has many earnest advocates in England and continental Europe, and orthopædic specialists, generally, adhere closely to this plan.

It finds its most conspicuous exponents in Robert Jones,² Bardenheuer,³ and Lucas-Championniere,⁴ but all agree that open operation, in selected cases, is imperative.

Robert Jones is strongly of the opinion that conservative technic, as followed in the past, should be radically revised with a marked improvement in end results. He challenges the non-operative results as shown by British Medical Association Commission, and dwells upon the fact that the frequent occurrence of mal-union, non-union, and deformities is without warrant or apology.

Referring to a statement in the British Medical Association report, that operative treatment of fractures is in its infancy, while conservative methods are well established, he rejoins sharply, that no method is to be regarded as "well established." Until end results are uniformly ideal, all methods must be subject to close scrutiny and final revision.

He believes that most surgeons err in sparing traction, or in employing it intermittently; and insists upon long-continued, uninterrupted pulley traction which alone is mechanically efficient. He refers to a case of fracture of the femur of four months' standing, with three inches overlapping, which was fully corrected by this procedure. He states, further, that reduction quite incomplete during primary anæsthesia may easily become complete within forty-eight hours under traction. In certain cases, delayed union is inevitable, but these are not to be classified as "ununited fractures."

Lucas-Championniere,⁴ 1895, advocated conservatism and relies upon

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mobilization and massage, as essential to success. He sets forth the following postulates:

- (1) A certain amount of mobility conduces to repair.
- (2) Absolute fixation is often disastrous, because of consequent atrophy of joint structures, tendons and muscles.
- (3) The more promptly resort is had to movement and massage, the more rapid will be repair.

Encircling splints or bandages are condemned. The significance of moderate shortening, as related to ultimate function, is minimized, and, in fractures involving joints, he pays more attention to function than to appearances.

I am of the opinion that this comment should be challenged, for, in my experience, good functional results in joint fractures are in direct ratio to anatomical reposition, which means normal contour.

It is not strange that the teaching of Lucas-Championniere has found few followers among American surgeons, who, in the main, believe that perfect anatomical and functional conditions are interdependent.

Hackenbusch⁵ is unreserved in his commendation of Lucas-Championniere's method, though with definite modifications. He applies plaster-of-Paris circular bandages. Later, the splint is divided at seat of fracture, and by means of an external mechanism, traction is exerted forcibly and continuously. The patient is then allowed freedom of movement. He deplores the effect of bed-life upon the patient, during treatment.

P. Watson⁶ (Edinburgh) approves of the ambulatory, massage method, but makes no reference to fractures of the femur. His results, as shown by radiograms, are to be commended, and loss of time compares favorably with cases treated by other methods.

Surgeons are generally familiar with the Bardenheuer method by the application of multiple traction. He calls special attention to the difficulties that are encountered in dealing with ankle-joint fractures, and adds that there is no joint fracture in which faulty treatment is so severely avenged. Referring to his results, covering a period of five years, he quotes two of his assistants to the end that Bardenheuer's results in lower leg fractures are ideal and fabulous.

To this he appends the statement that his results since the above report was made are equally good. He insists that his method is simple and easily acquired, but admits that it involves great painstaking, and can be best carried out in hospitals. He suggests, very wisely, that every hospital should maintain a fracture department under the care of trained specialists.

E. Lexer,⁷ heartily in sympathy with Bardenheuer, resents the modern tendency to frequent operation, believing that cases requiring operation will always remain limited in number. He adheres to no special method, but deals with each individual fracture as a separate entity. He warns against long-continued splint life as affecting future function.

F. Steinmann,⁸ in 1907, devised his method of direct traction by passing a nail through the distal fragment, to the protruding ends of which he attaches a stirrup by which a cord and pulley are enabled to develop traction at any angle or level.

The advantages of this appliance over adhesive plaster are obvious, particularly in fat subjects or when the fracture is near the distal end of the bone, as in the lower leg or ankle-joint. The danger of infection is its one fault, but with ordinary precautions this is not a serious obstacle.

P. Ewald⁹ and George Woolsey,¹⁰ advocates of conservatism, have frequent resort to the Steinmann traction method and regard it as an invaluable accession to surgical technic.

Without doubt, much is yet to be learned concerning the conservative treatment of recent fractures. Past results have shown by far too many failures and in no sense furnish a criterion in the setting up of present day standards. Moreover, we must not ignore the fact that purely mechanical methods require a measure of enthusiasm, ingenuity, and special training, which are beyond the capabilities of the average surgeon. Time exactions upon patient and attendants are, also, a formidable consideration, and in many cases will determine the selection of other than the bloodless method.

The exponents of conservatism seem to ignore one very important consideration, viz.: that, in doubtful cases, where early efforts at reposition are ineffectual, there will remain a doubt as to the ultimate loss of function and earning power thereby entailed, until many weeks or months have elapsed.

If, as will happen with greater or less frequency, the result proves unsatisfactory, a proposal to revise the work by a secondary operation will uniformly be accepted by the patient with hesitation, if not resentment.

Operative Treatment.—The open method, with its assurance of immediate, accurate reposition of fragments and ultimate restitution of function, appeals strongly to most surgeons who are in the habit of associating ideal restoration with the best possible functional results.

Despite the analytical investigation of fracture treatment, as recorded

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in the tremendous volume of literature which has accumulated in the past decade, it is still a fact that choice of method conforms to no fixed law.

While conservatism, as taught by those who are its masters, meets present day requirements in a vast majority of cases, operative treatment is *imperative* in an ever varying minority. Collateral conditions, personal preference and experience will ever be responsible for the wide discrepancies in individual practice of extremists, as illustrated by Bardenheuer on the one hand, and Lane on the other. In the final analysis, true conservatism finds expression in the nearest approach to ideal end results, and this consideration must, in the long run, determine action.

It is fundamental that repeated efforts at bloodless reduction, under the most favorable conditions, must be made before conservatism is abandoned. Good alignment and minimum displacement meet ordinary requirements. Over-riding of fragments, spiral displacements, and interferences will certainly prove a serious obstacle to permanent reduction and a menace to future efficiency.

The propriety of operative treatment of fractures was suggested by E. S. Cooper,¹¹ of San Francisco, in 1861, when he anticipated Sir Joseph Lister and successfully opened the knee-joint and wired a fracture of the patella, relying upon alcohol as a wound dressing. He, also, removed a floating cartilage from the knee-joint in 1859. Cooper, however, was regarded as a dreamer, and his work remained in obscurity until Lister,¹¹⁰ in 1871, announced that, with immunity from infection then attainable, the knee-joint could be opened in the presence of patellar fractures with almost absolute safety.

It is interesting to note that, prior to this date, 1870, Lister successfully treated an old fracture of the ulna and dislocation of head of radius. Through his teaching, the open treatment of patellar fractures came to be regarded as an accredited procedure. It seems strange that, with the precedent thereby established, the open treatment of recent fractures of long bones did not at once attract serious attention. Resort to this method was had sporadically until early in the last decade of the last century, when it became more general.

About twenty years ago W. Arbuthnot Lane became an earnest advocate of the operative treatment of fractures, and by him the method became popularized. His use of metal fixation material has been followed by a large number of surgeons throughout the world, until the Lane plate has become a household word in most hospitals. Gradually, however, it has been discovered that the use of foreign material in large volume, as advocated by Lane and his followers, is not without

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serious disadvantages, and it is to be regarded as fundamental that the smallest possible amount of such material gives greatest assurance of ultimate success. It is proven beyond doubt that the presence of metal plates and screws exerts a deterrent effect upon bone repair. The following case admirably illustrates this point:

So recently as June 3, 1915, a patient presented himself at my office, with the following history: A healthy man, age thirty-five years, six months previously had sustained a fracture below the middle of the tibia and fibula. Ten days later, the fragments being irreducible, a competent surgeon operated and fixed the fragments with a Lane plate nearly four inches long, which required four screws. The wound healed promptly and the patient, after remaining in the hospital for two months, was discharged with an apparently perfect result. Union, however, was not solid. Gradually there developed an antero-posterior angulation, with manifest pseudarthrosis. I at once referred the patient back to his surgeon with the suggestion that he remove the plate, correct the deformity, and await results. It seems probable that further operative interference will be necessary, before good union is secured.*

Before this Association, in 1897, Joseph Ransohoff¹² presented a paper upon the operative treatment of recent fractures, and reported seven successful cases. He stated his opinion, as follows:

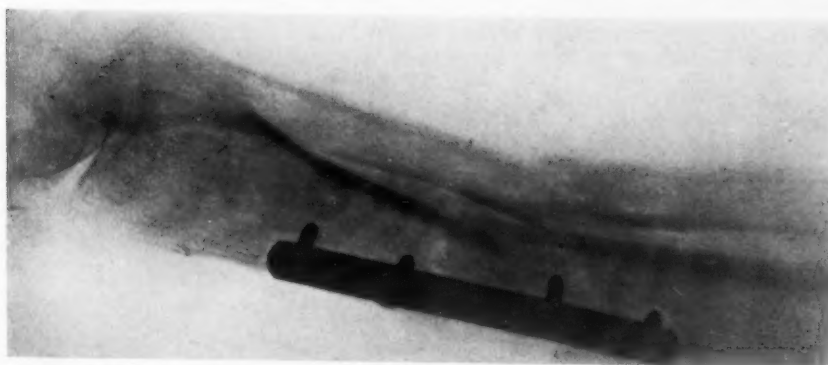
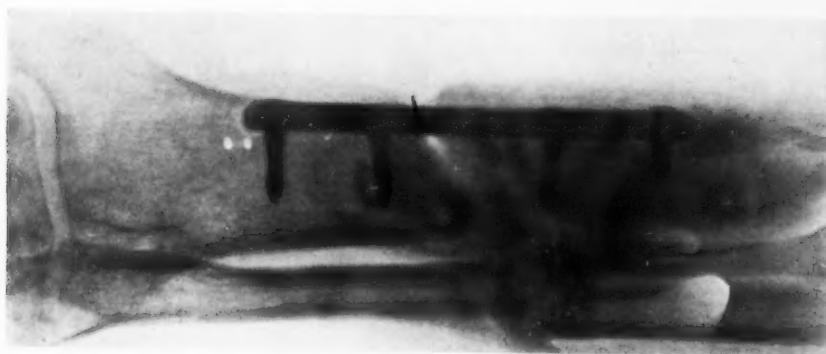
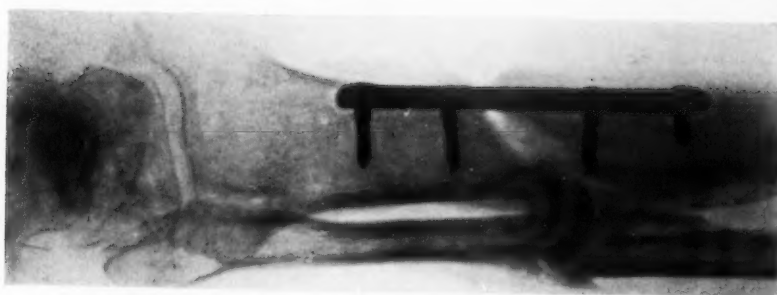
"Except in the simplest variety of fractures, we share with our predecessors the anxieties that attend incomplete reduction, deformity, shortening, and loss of function." He expressed implicit faith in the legitimacy of the open method, but cautioned against indiscriminate resort to it.

Campiche,¹³ of San Francisco, maintains that "open operations on recent closed fractures, as they are done to-day—wholesale and indiscriminately—are unnecessary in most cases," and adds, "that conservatism will succeed in 90 per cent. of cases."

Of 2100 fractures of all types, treated at Roosevelt Hospital, in two years, Darrach¹⁴ found that 104, or 5 per cent., required open operation. His operative results in recent fractures were ideal in 71 per cent.; fair in 21 per cent.; bad in 8 per cent. His results in old fractures were good or ideal in 30 per cent.; fair in 47 per cent.; bad in 23 per cent.

In 21 of 56 recent cases, he employed no fixation appliances, depending solely upon readjustment and interlocking. In 17 cases,

* August 1, 1915, union still manifest.





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he used simply catgut suture. Foreign material was used in but 18 cases. For the maintenance of alignment, he relies wholly upon external splints.

F. J. Cotton¹⁵ believes that a *large percentage* of fractures cannot be reduced and held in place without operation. He expresses the further opinion that one-half of the fractures of the femur and one-fourth of those of the humerus will be subjected to operation in the near future.

Surgeons, generally, are not in accord with the opinion of Robert Jones, who opposes operative interference in fractures of both bones of the forearm at or near the middle.

When it is considered that the muscular thrust upon the four fragments involved in this fracture forms a serious obstacle to permanent reduction, the propriety of operation requires little to be said in justification.

W. I. Terry, of San Francisco, in a personal communication, states that his operative results in fractures, generally, are superior to his non-operative, both as to time loss and restoration of function. He operates under the stipulation that fixation material may be removed after union is secured. He also states that, in compound fractures, direct fixation lessens the period of disability.

In an exhaustive article upon "Fracture of the Capitellum," J. H. Jopson¹⁶ reports 1 case which yielded a good result by open operation. He refers to 9 cases studied by Carlton P. Flint, 6 of which were subjected to operation. Two of the 6 were compound and required partial resection. In 3 cases, the fragment was removed; end result not given. The sixth case was treated (by Stimson) by suturing the fragment in place with good result.

Reviewing a large number of cases treated conservatively, he finds that the end results were uniformly unsatisfactory.

Royal Whitman¹⁷ reports 5 cases of fracture of the neck of the femur treated by the operative method without mechanical fixation. He operates by the anterior route, freshens the ends of fragments, and places the patient in a plaster spica with abduction. His results were excellent in each case.

Sherman and Tait,¹⁸ of San Francisco, approve of the open method by the transarticular route in certain joint fractures. Their position finds ample support in the fact that the open method for fractures of the patella is highly accredited.

Stillman, of San Francisco, in a personal communication, accords to the foregoing for shoulder, elbow, and ankle fractures.

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Through the kindness of Dr. Emmet Rixford, of San Francisco, I have, recently, seen a case in which there was a transverse fracture at the neck of the radius. The upper end of the shaft was displaced forward. The head of the radius was turned out of the orbicular ligament, at right angles to its normal position, the articular surface pointing outward.

A few days later, Dr. Rixford opened the elbow by a lateral incision over the capitellum and head of radius. The head of the radius was turned into place under the orbicular ligament, thereby securing accurate reposition without bone suture. There was perfect wound healing.

Five weeks later, the contour of the elbow was normal, and there was promise of resumption of normal function in the joint.

Dr. Rixford makes a valuable comment regarding joint fractures, which fully explains certain features connected with these injuries.

He says, in a personal communication: "In joint fractures, if only epiphyseal bone is involved, there is little resultant callus. This is illustrated in fractures of short bones. If diaphyseal bone is involved, a greater amount of callus is produced, and becomes a menace to joint function and may result in ankylosis."

J. Hogarth Pringle,¹⁹ in a most interesting review of 230 cases of open fractures of long bones, at the Glasgow Royal Infirmary, makes the following observation. All of the 230 cases were treated by the open method. There were 207 males and 23 females. The age distribution was as follows: First decade 11; second 38; third 52; fourth 47; fifth 43; sixth 24; seventh 13; eighth and ninth 2.

Anatomical Classification	Immediate Amputation
Upper arm 39	20 or 51.2 per cent.
Forearm 31	9 or 29 per cent.
Femur 21	4 or 19 per cent.
Leg 139	33 or 23.7 per cent.

He calls especial attention to the seriousness of upper arm lesions, 51 per cent. of which required immediate amputation. There was an attempt to save the limb in 159 cases. Direct fixation was used in 112 cases, with 9 deaths from various causes; and 7 secondary amputations. The balance recovered with a useful limb.

The average hospital residence was 62 days; the longest period, 200 days.

He advises thorough primary cleansing of the wound and enlarging the skin wound, when necessary, and removing loose fragments.

E. W. H. Groves,²⁰ writing upon the subject of compound and

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comminuted fractures, quotes Lane and Lambotte as opposed to operative interference; emphasizes the dangers from infection; advises extreme gentleness and minimum of interference. In selected cases, he uses an apparatus similar to that of Lambotte which depends, for fixation, upon external bars.

J. B. Murphy has, many times, and in unmeasured terms, condemned meddlesome interference in open fractures, and there seems to be a general consensus of opinion, on the part of surgeons of large experience, to the end that it is better to await the permanent closure of the external wound before resorting to radical corrective measures.

Recalling the fact that open fractures, like all lacerated wounds, are *ab initio* the seat of infections, it is obviously hazardous to adopt any measure which will, almost inevitably, result in spreading infection.

With the free use of iodine, externally, and upon wound margins, we may reasonably hope that, in many cases, wound repair will progress rapidly, with the assurance of an early establishment of asepticity at the seat of fracture.

A signal advance in this field, during the past five years, is found in the use of the bone transplant, both in fresh and old fractures. After careful experimentation, the autogenous transplant has arrived at general acceptability, and it has been clearly demonstrated that the autogenous graft becomes a living entity in its new location. On the other hand, bone from a lower animal presents all of the objections urged against metal or other foreign bodies. Two methods of application have been advocated; first, the mortising of the transplant into the cortex of the bone; second, the placing of it within the medullary cavity.

Several instances of delayed union and of re-fracture, following the latter method, tend to discredit this procedure, on the ground that the medulla does not afford a proper habitat for the transplant, which, consequently, tends definitely to inhibit firm union.

According to Edouard Streissler,²¹ Wilms recommended the use of bone grafts for recent fractures of the forearm, in 1909. Lexer, in 1908, suggested the use of the bone peg in the treatment of fractures of the femoral neck.

Regarding the importance of retained periosteum, in bone grafts, opinions vary greatly. C. A. McWilliams,²² experimenting on dogs, insists that the periosteum should be retained, on the ground that it renders the transplant more permeable to blood-vessels, whereby its viability is assured. He thinks that Murphy overlooks the real value of this step. He reports 87 per cent. of successes where the periosteum

was retained, and only 48 per cent. of successes where the periosteum was removed.

I have found that the periosteum of the graft may be preserved *in situ*, during operation, by wrapping the fragment closely with zero catgut. Before closing the wound, the strands of gut are divided and removed or cut short.

A. P. C. Ashhurst²³ suggests that the periosteum is chiefly valuable in protecting the graft from ultimate absorption. In the treatment of fractures of the femoral neck, he employs anterior incision through the capsule, re-freshens the ends of fragments, and then drives a bone peg through the trochanter into the head of the bone. He reports one case with a fairly good result, but eight months later there was slight coxa vara, due to lack of precautions on the part of the patient.

J. B. Conant,²⁴ reviewing results attending fractures of the femoral neck, with reference to end results, concludes that they may be greatly improved by open operation and fixation of fragments with bone or nail.

E. F. Robinson²⁵ reports 5 cases of ununited fractures of the tibia treated by bone transplants, with uniform success. He states that there was union at the end of four, six, ten, eight, and seven weeks respectively.

F. H. Albee²⁶ calls attention to the manifest advantage of the inlay splint, as contrasted with the intramedullary graft. He states that the bone graft is a trustworthy surgical agent, and has employed it with uniform success in over 350 cases. He states that, even in the presence of a mild infection, the autogenous splint will survive. He contends that the bone graft should retain all its elements—periosteum, bone and marrow—and has wholly discarded the use of metal in any form. He employs this method in both recent and old cases.

G. Freiherr von Saar,²⁷ in a paper upon the treatment of supracondylar fractures of the humerus, says that, while many of these fractures, and especially those in young subjects, are amenable to conservative treatment, a considerable proportion in adults present insuperable difficulties and are best treated by the operative method. He proceeds by freely opening the joint and replacing the fragments. In those cases where the bone transplant is applicable, he does not hesitate to use it, and finds that, frequently, the detached portions of bone can be accurately replaced and the joint structure, thereby, made to resume normal conditions. He reports 6 complicated cases of this sort, occurring at the Innsbrucker Clinic, during the past two years, with excellent results.

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In compound fractures, he advocates waiting until the external wound has healed before interference is undertaken. He refers to the work of Perthes who implanted, upon the lower end of the fragment, cartilage from the joint to secure later function. He insists upon long and patient orthopaedic after-treatment in all his cases.

W. M. Brickner²⁸ is an ardent advocate of autoplasmic bone grafting in the presence of non-union. He reports two cases of non-union following the use of metal plates. Both were successfully treated by bone grafts. He relies upon external splinting for alignment, insisting that no plate or bone suture can be relied upon to perform this office.

His conclusions are: First, that metal plates often cause delayed or non-union; second, that the bone graft stimulates osteogenesis; third, there is gradually a fusion of the graft, but not complete absorption.

M. S. Henderson,²⁹ with a large experience, coincides with the views of McWilliams and retains normal periosteum. He reports 9 cases of fracture treated by autogenous transplant; 3 of which were originally compound fractures. In preparation of his graft, he uses a circular saw, and by preference uses the sliding method, thereby he takes the transplant from the fragments.

I wish to report 2 cases of old fracture of the femur of long standing non-union. The first was previously plated twice, and the second once. In the first case, a bone insert from the tibia succeeded perfectly. In the second case, I used an intramedullary splint, taking a segment of the entire fibula, without periosteum, for this purpose. In the presence of a slight infection, the transplant remained *in situ* until good union was established after a period of seventeen weeks. At that time, owing to a persistent sinus, I removed the transplant and the case was permanently cured. The resultant function in neither was ideal, but the best that could be secured under the circumstances.

A third case was that of an old ununited fracture of the humerus, treated by intramedullary transplant. This was an utter failure, though ultimate union, with good function, was secured by wiring.

These cases well illustrate the value of the implant as opposed to the intramedullary splint.

C. F. Walters³⁰ comments upon the use of the intramedullary bone peg as against the usual metal plate. He reports 4 cases with varying results and concludes that this method, in its present form, is unsatisfactory and inferior to bone transplant.

A comprehensive survey of the literature of fractures, covering the past ten years, has led me to the following conclusions:

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First, the public demands, and is entitled to, better results from fracture treatment than have, hitherto, been obtained.

Second, that from 80 to 90 per cent. of long-bone fractures can be successfully treated by the closed method.

Third, that conservative treatment exacts a high degree of skill and close attention to details.

Fourth, that resort to the open method is of too frequent occurrence.

Fifth, that the least possible amount of foreign fixation material should be the rule.

Sixth, that steel plates, in the treatment of fractures, are a menace from the stand-point of permanency.

Seventh, that the bone implant is the fixation material of choice.

Eighth, that intramedullary splints are inferior to the autogenous bone implant.

Ninth, that fixation material of whatever type is not to be relied upon for maintenance of alignment.

Tenth, that cases of non-union and faulty union which come to secondary operation indicate indifferent methods of primary treatment.

Eleventh, operative treatment of compound fractures should be withheld until the external wound healing is perfected.

Twelfth, many joint fractures can only be treated successfully by the open method.

Thirteenth, that normal contour and good function are closely related in end results of all fractures.

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END RESULTS OF BONE FRACTURES*

REPORT OF THE COMMITTEE OF THE AMERICAN SURGICAL ASSOCIATION

By W. L. ESTES, M.D. (*Chairman*)

THE committee has confined its investigation to fractures of long bones. The regions for study were established as follows:

1. Upper Extremity:

- (a) Humerus—(1) neck; (2) shaft; (3) condyle.
- (b) Radius—(1) extremities; (2) shaft.
- (c) Ulna—(1) extremities; (2) shaft.
- (d) Both bones of forearm—(1) shaft; (2) Colles.

2. Lower Extremity:

- (a) Femur—(1) neck; (2) shaft—(a) upper third, (b) middle third, (c) lower third.
- (b) Tibia—(1) extremities; (2) shaft.
- (c) Fibula—(1) extremities; (2) shaft.
- (d) Both bones of the leg—(1) shaft; (2) Pott's.

Compound fractures are studied under the same divisions and classification as the simple ones are.

The Committee sets itself the task of trying to determine especially three points:

1. To find out the average present day results in both simple and compound fractures as regards anatomical and functional results in the several age groups, and the average time of disability. This latter period is determined to mean the average time the patient lost from work or his ordinary duties.

2. The comparative value of (a) the conservative or closed methods, (b) the operative or open methods.

3. The comparative value of immediate or delayed treatment in each group of cases.

In order to accomplish the collection and examination of cases, a number of Fellows, surgeons in the various cities of the United States and Canada, were asked to serve as associate members of the committee. The following Fellows undertook the task of collecting and examining or having examined the end results of fractures in the hospitals of their respective cities: Dr. M. L. Harris, Chicago, Ill.; Dr. J. F. Buchanan, Pittsburgh, Pa.; Dr. R. Matas, New Orleans, La.; Dr. C. L. Scudder, Boston, Mass.; Dr. A. F. Jonas, Omaha, Neb.; Dr. A. Primrose, Toronto, Canada; Dr. A. MacLaren, St. Paul, Minn. We wish gratefully to acknowledge their very great help in this work.

* Read before the American Surgical Association, June 9, 1915.

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Also the Committee is indebted to Dr. W. E. Lee, Dr. Sergeant Martin, Dr. C. R. Steinke and Dr. R. L. John, all of Philadelphia, for their efforts in collecting and examining cases, and the free offering to the committee of the labor they had expended in personally examining and formulating the record of a large number of cases. The Committee wishes to give credit to these gentlemen and to offer them sincere thanks for their assistance.

The set of questions indicated by the accompanying blank form was used in collecting the data.

AMERICAN SURGICAL ASSOCIATION. COMMITTEE ON FRACTURES.

1. Patient's Initials..... Age..... Occupation.....
2. Cause of Fracture. { Direct Violence.....
Indirect Violence.....
3. Bone Affected. { Neck.....
Upper Third.....
Middle Third.....
Lower Third.....
Condyle.....
4. Kind of Fracture. { Transverse.....
Oblique.....
Spiral.....
Comminuted.....
Simple.....
Compound.....
5. Method of Reduction and Treatment.
 - a. Anæsthetic or not?.....
 - b. Fixation.

Closed Method. <ol style="list-style-type: none"> 1. Splints.....Kind..... 2. Plaster of Paris..... 3. Traction. { Buck's..... Bardenheuer..... Steinmann..... Jones..... 	Open Method. <ol style="list-style-type: none"> 1. Immediate or delayed operation..... 2. Simply for reduction..... 3. Plates.....Kind..... 4. Wire..... 5. Nails.....
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6. Amount of Shortening.
 1. First dressings.....
 2. When all apparatus was removed.....
 3. When discharged from the hospital.....
 4. At latest observation.....
 5. State how measurements were taken.....
7. Was X-ray used?.....At what stage of treatment.....
What did it show the position of fragments to be.....
8. Length of time in bed.....
9. Length of time crutches, canes, or other aids to walking were used.....
10. Length of time absent from work.....
11. Is patient able to take his former job?.....
12. Disability at last observation, estimated by:
 - a. Deformity.....
 - b. Endurance.....
 - c. Pain.....
 - d. Swelling.....
 - e. Interference with joint function.....
13. Mortality.....%
 - a. Cause of death.....
 - b. Location and kind of fracture.....
 - c. Age of patient.....

The Committee collected 1745 cases; non-operative 1358 and operative 387. There were of the simple fractures 258 cases operated and of the compound 129 cases. The results of these cases have been carefully investigated.

Unfortunately the records of many of these cases were so incomplete they could not be used in their entirety.

The cases have been tabulated under six principal heads, viz.:

1. To show the results in the following age periods, viz.: (a) under 15 years, (b) 15-45 years, (c) 45-60 years, (d) over 60 years.
2. To show the effect of good anatomical restitution in shortening the period of disability and restoring full function.
3. To show the comparative results in the treatment of simple fractures of the operative (open) method and the non-operative (closed) method in the several age groups.
4. To show the result of the operative and non-operative methods in the treatment of compound fractures also considered as regards the several age groups.
5. To show the results of treatment of the fractures of the several long bones in the various regions, in the several age groups in order to determine the average period of disability and to standardize the average recovery.
6. To show the comparative results of immediate and delayed treatment of the closed and open methods of treatment in the several age groups.

The operative cases are considered as (1) immediate and (2) delayed.

It was determined to class all operations performed within ten days after the injury under immediate operation; those done after this period are classed as delayed operations.

The results of cases of non-union and those following operations for deformities resulting from fractures are not included nor considered in the report at all.

The Committee finds:

First, the results are best in the age period under fifteen years. Conservative treatment is generally effectual during this period.

Second, good anatomical restitution of a fractured long bone always results in the best functional result and has the shortest period of disability.

Third, while few open operations are reported under the fifteen-year-age period it seems to make little difference in the result, except in senile cases, what the age period is when the operation is done.

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Fourth, the end results of non-operative and operative treatment of compound fracture show very little difference in the anatomical result, but the functional results are better after operative treatment, except in compound fracture of the shafts of both bones of the leg, here the reverse seems to be true.

The age period except in senile cases has no marked effect on the result of the treatment.

Fifth, the average period of disability (that is, the time lost from work) in simple fractures is as follows:

For fracture of the shaft of the humerus	14	weeks
For fracture at head and neck of the humerus	11.5	weeks
For fracture at condyle of the humerus	9.0	weeks
For fracture of the shaft of both bones of the forearm	10.8	weeks
For fracture of the femur, all sites	7.37	months
For fracture of the leg, all sites	4.75	months

NOTE.—These averages must not be considered as absolutely conclusive, as so comparatively few records have the point accurately noted.

Periods of disability were not recorded accurately nor generally in compound fractures. The reporter finds in his own cases (51 in number), the period of disability to be,

For fracture of the femur	13	months
For fractures of the leg	6	months
For fracture of the upper extremity	4	months

Sixth, the humerus should not show more than 1 cm. shortening and no appreciable angulation. Musculospiral paralysis should not result.

The forearm bones should show no appreciable shortening and pronation and supination should be unhindered. Function should always be good and no lasting pain result.

Fracture of the shaft of the femur should not result in shortening greater than two centimetres, nor in a fixed position of angulation or rotation which will affect the joints and require new habits of balancing or tilting of the pelvis; joint function should be good. No permanent disability of the affected member should result.

Fracture of the shaft of the bones of the leg should result in no appreciable shortening and no angulation. Joint function should be preserved.

Seventh, there is no method or splint universally applicable, nor has any given splint or apparatus proved its superiority. All depends upon the discrimination of the surgeon and the manner in which the apparatus is applied and maintained.

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It is evident that traction methods are most frequently unskillfully employed. As a rule, too little weight is used. *The gauge of the proper weight required is that necessary to overcome the shortening.* This should be determined by careful daily measurement. Traction methods require, as a rule, countertraction.

Plaster casts and moulded splints are especially indicated and useful after a fracture has been satisfactorily reduced.

RECOMMENDATIONS

1. The committee recommends as a general principle that fractures be treated by a skilled surgeon.

2. X-ray should be employed by a competent radiographer, or a fluoroscope should be used for diagnostic purposes before the permanent dressing is applied. At least two skiagrams should be taken, and they should be taken from opposite perpendicular directions.

Skiagrams should also be taken after permanent dressings are applied to prove proper reduction, and at the end of the treatment to show the result of the union and for the purpose of a graphic record.

3. Fractures should be reduced immediately after the injury if possible to obtain and apply proper retaining apparatus or splints. The statistics show markedly better results when the treatment is begun at once. It is, however, not only useless but cruel to subject the patient to the pain of manipulation for reduction unless the surgeon has proper fixation apparatus at hand and the patient is where he may have a permanent dressing applied.

4. General anaesthesia should be employed as a rule to facilitate reduction and prevent pain, unless the condition of the patient contra-indicates it.

5. Neither the non-operative nor the operative method is to be recommended exclusively. Each has its indication and should be employed when required. Generally speaking, the age period under fifteen years is the period in which non-operative methods are especially effectual. In the other age periods up to sixty years, operative methods may with confidence be employed when non-operative treatment has proved ineffectual in reducing, or controlling the fragments in proper position. The operation should not be delayed longer than one week after the injury.

6. The open method when adopted should be employed early. It may be used at any age period, except in senile cases, whenever a skiagram shows a deformity or a position of the fragments which

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obviously cannot be reduced or when proper efforts at reduction and retention have proved unavailing.

7. Some form of rigid plate applied directly to the bone or an Albee "inlay" seems to be the best fixation method in operative cases.

8. Open operations for simple fractures should be undertaken only by experienced surgeons who are thoroughly equipped by training and who have proper instruments and apparatus to meet all the possible indications of the operation.

9. The work of this committee has been greatly hampered by the inadequacy of the records submitted for its consideration. A large proportion of the cases had to be rejected entirely and most of them were so incomplete as to make deductions based upon them possibly misleading.

The first step in the betterment of practice is the study of results achieved by present day methods. An adequate study is impossible without adequate records.

The committee strongly urges the American Surgical Association to set its seal of approval upon the standard form of record submitted by the committee, and to further petition the American Medical Association to do the same. The committee also urges each member of this Association faithfully to keep these records in his practice and to see that they are kept in the hospitals to which he is attached.

The committee further recommends that a copy of the approved form be sent to all corporations within the United States of sufficient importance to have their own relief organizations or medical service or both; to all accident insurance companies to be embodied and incorporated in the papers given to the insured, with the requirement that they be filled at the time of an accident involving fracture; to all hospital boards with the request that these records be made a part of the routine records of fracture patients, pointing out that thus not only are the hospital and its surgeons protected in case of litigation, but that most valuable material is being collected to serve for attaining better results in the treatment of fractures.

AUTOPLASTIC REPAIR OF FRACTURES OF NECK OF THE FEMUR

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DURING the past year reports have been published by Albee,¹ Henderson,² Ashhurst,³ and others on the autoplasmic repair of ununited fractures of the neck of the femur and by the writer⁴ on the autoplasmic repair of recent fractures at the same location.

Failures and unsatisfactory results have been reported on several occasions, but an analysis of the reports in the unfavorable cases seems to indicate that these results were due to the errors in technic in the operation or after-treatment, necessarily accompanying any new surgical procedure, which should rapidly be eliminated by additional experience.

Improvements in technic apparently can be made along the following lines:

I. *The Selection of the Transplant.*—The experience of the writer indicates that a section of fibula makes the most satisfactory transplant for either recent or ununited fracture of the neck of the femur, because:

1. It is the size of bone adapted to the purpose.
2. The requisite length is easily obtainable.
3. It is irregularly round and will not rotate like a dowelled peg.
4. It is a tube of compact bone which is mechanically stronger than the same amount of compact bone in a solid piece.
5. It is lighter than a solid sawed peg.
6. Its elasticity is greater than a solid transplant, more closely conforming to the elastic character of a normal neck of the femur.
7. It is filled with undisturbed marrow which aids in the viability of the transplant.
8. It presents a continuous circular surface of the cambium layer to the host bone for grafting and to stimulate osteogenesis in and around the defect.

The transplant should be obtained from the fibula of the same extremity, limiting the operation to one extremity.

The periosteum should be stripped from the transplant as it is removed, because the periosteum is a limiting membrane of fibrous tissue and when buried in bone its presence prevents bone to bone apposi-

FRACTURES OF NECK OF THE FEMUR

tion and the grafting process which is essential to the repair of the fracture.

After the periosteum has been removed the surface of the fibular peg should not be further disturbed in order to preserve the cambium layer, rich in osteogenic cells lying upon the surface of the compact bone beneath the periosteum and especially active in the grafting process.

The canal in the femur should be fitted to the fibular peg, not the peg to the canal, as trimming the peg would thin the tube of bone and lessen its strength.

II. *The Application of the Transplant to the Fracture.*—The published Röntgenograms of the cases which resulted unsatisfactorily show that the transplants were placed in the soft cancellous bone at nearly a right angle to the shaft of the femur, a poor bone support for the transplant against intermittent muscular spasm and a bad angle of leverage for the transplant in weight bearing.

A better application of the transplant to this fracture is illustrated by a longitudinal section of a prepared fresh specimen, showing a fibular peg across the line of fracture impinging upon the bony points of leverage which support the head and neck of the bone in their normal anatomical alignment (Fig. 1).

The bone peg rests at *A* on a strong mass of compact bone, reinforced by the base of the lesser trochanter. The lower end of the peg is held securely in the opening made for it in the compact bone of the shaft at *B*, and the upper end is firmly imbedded in the transitional bone against the cartilage at *C*. The peg is placed so that it acts as a powerful lever, with *A* as the fulcrum, *AB* acting as the long arm and *AC* as the short arm of the lever supporting the upper fragment.

The wide angle *CAD*, about 135 degrees, between the peg and the axis of the shaft of the femur, materially increases the mechanical strength of the autoplasmic repair at the line of fracture and substantially increases the resistance of the peg to cross-breaking strain at the line of fracture when the weight of the body is sustained in walking.

The upper end of the peg impinges against the cartilage of the head of the bone above the depression for the attachment of the ligamentum teres, otherwise the nutrient artery of the head of the bone which enters through that ligamentum might be destroyed and necrosis of the upper fragment occur. The firm bone at the point of the depression to receive the ligament is correspondingly thinner and would give less support for the peg.

III. *The Immobilization of the Fracture and Transplant.*—It is

essential to the grafting process that the autoplasmic peg remains in stable contact with the recipient bone, without any motion whatever between them, to accomplish which, all muscular spasm and all leverage movement on the transplant at the line of fracture must be prevented.

The muscular spasm can be prevented by relaxing the muscles concerned by the position of immobilization of the extremity. Abduction and external rotation of the thigh relax the muscles attached to the greater trochanter; flexion and outward rotation of the thigh relax the iliopsoas muscle; abduction of the thigh causes the iliopsoas to pull the fragments directly together after reduction in fracture of the neck of the femur; flexion of the leg on the thigh relaxes the hamstring muscles; consequently, to prevent muscular spasm and intermittent movement between the graft and recipient fragments, the thigh is strongly *abducted* and strongly *rotated outward*; slightly flexed on the trunk and the leg slightly flexed on the thigh.

The hip-joint should be immobilized in this position by a strong body plaster-of-Paris cast. If a short spica is used the patient will be able to tilt the pelvis and change the position of the hip-joint on the injured side by bending the spinal column, consequently, the spinal column should be immobilized by a wide body part of the cast fixed against the thorax. If the opposite hip-joint is allowed to remain free, the patient will be able to tilt the pelvis and shift the position of the fractured hip, consequently, the opposite hip-joint should be immobilized by including the uninjured thigh in abduction in the body cast (Fig. 2).

This immobilization should be retained during convalescence, until the fibular transplant has grafted to the surrounding bone and union has occurred between the fragments.

The immobilization should be retained without change for eight to ten weeks, and weight bearing should be prohibited for some time longer in recent fractures of the neck of the femur. A very much longer time is required for repair and regeneration of bone in ununited fractures of the neck of the femur, depending in the individual case upon the length of time after the original fracture, the condition of the small fragment, as to its viability and amount of absorption and the general condition of the patient. Röntgenographic examination will demonstrate the condition of the repair and should determine the length of time of immobilization. Body weight bearing should not be allowed until the Röntgenogram shows repair of the pseudarthrosis and not until functional movements of the hip-joint have been restored.

Autoplasmic repair of the neck of the femur for either recent or ununited fracture is contra-indicated in the aged, where the shock of



FIG. 1.—Longitudinal section of a prepared specimen, illustrating repair of fracture of the neck of the femur by a fibular peg.



FIG. 2.—Position of immobilization in autoplasmic repair of fracture of the neck of the femur.



FIG. 3.—Case I. Photograph of post-mortem specimen of united fracture of the neck of the femur.



FIG. 4.—Case I. Photograph of a longitudinal section of Fig. 3, showing union between the fragments and grafting of the transplant to its host.



FIG. 5.—Case II. Photograph of post-mortem specimen of ununited fracture of the neck of the femur.

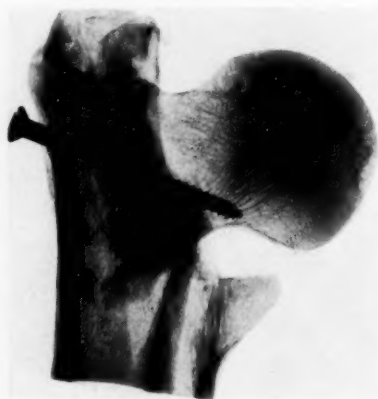


FIG. 6.—Case II. Röntgenogram of Fig. 5.

FRACTURES OF NECK OF THE FEMUR

operation, the effects of anaesthesia or the prolonged immobilization might seriously endanger life.

The results of a personal operation for autoplasmic bone repair for recent fracture of the neck of the femur are extremely illuminating as showing the course of early bone production around the transplant in the cancellous bone of the neck of the femur and the rapid union of the line of the fracture.

CASE I.—A fracture of the neck of the right femur, in a patient fifty-six years of age, was repaired twelve days after the injury by the insertion of a fibular transplant. The wounds healed by primary union. The patient died twenty-three days after operation.

The pathological specimen showed good union at the line of fracture (Fig. 3). A longitudinal section through the head and neck of the femur and the fibular transplant showed the following conditions (Fig. 4):

The transplant was solidly embedded in the surrounding bone, being substantially attached both to the cortical bone to which it was contacted and to adjacent cancellous bone of the neck. Radiating from the graft in every direction was a mass of hard bone, infiltrating the cancellous bone and grafting the transplant firmly to its host. The medullary canal of the fibular transplant was sealed at each end by a plug of hard bone and the remainder of the canal was filled with marrow.

The line of fracture was not discernible on the cut surface of the section of the specimen.

CASE II.—A fracture of the neck of the right femur, in a patient fifty-four years of age, was treated by open operation and internal fixation with a large metal screw, seventeen days after the injury. The wound healed by primary union. The patient died twenty-five days after operation.⁵

The pathological specimen (Fig. 5) showed only fibrous union between the fragments. The screw was loose and movable in the trochanter, which with the fibrous union allowed considerable movement between the fragments. A Röntgenogram of the specimen showed the direction and position of the loose screw (Fig. 6).

CONCLUSIONS

1. Autoplasmic transplantation of bone is the best treatment for both recent and ununited fractures of the neck of the femur, unless contra-indicated by age or condition.
2. The fibula furnishes the transplant of choice.

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3. *The transplant impinging on the points of compact bone as described will graft to these points of leverage and give strong support to the line of fracture.*

4. The transplant imbedded in cancellous bone will stimulate the production of osteoblasts and the growth of new semicompact bone in the cancellous area around the transplant, grafting them together by bony union.

5. *The transplant must be completely immobilized until it has grafted to the recipient bone.*

6. *The position of immobilization must be extreme abduction and external rotation of the thigh.*

7. The plaster case to be effective must extend from the axilla to the toes on the injured side and also include the opposite thigh in abduction.

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- ⁵ Reported by permission from the records of a colleague.

EXTENSION AND REDUCTION OF TRANSVERSE OR SERRATED FRACTURES OF THE FEMUR *

BY HERBERT GIFFORD, M.D.,
OF SYRACUSE, N. Y.

A METHOD which the author has found extremely advantageous in reduction and immobilization of those fractures of the lower portion of the femur whose fracture planes are either transverse enough or jagged enough to catch and hold each other once they are well reduced, may be described under the three heads of material, technic, and mechanics, as follows:

(I) *Material*.—1. Table, substantially built. One may be improvised with legs of 2 x 4 of convenient height, well braced; top of two pieces of 1 or 2 x 6, laid with a longitudinal space of two or three inches between them. The table is firmly anchored to the floor, and to one end of it an ordinary hospital back-rest may be attached, though the latter is not strictly necessary.

2. Swath, preferably of outing flannel, from five to ten inches wide, and from five to ten yards long.

3. Metal strap (Norway iron is good stuff), from one to three-sixteenths inches thick, and from half to one and a fourth inches wide, long enough to outline the well-padded foot and leg from the lower calf behind, beneath the sole, and up to the upper third of the leg in front. (See Fig. 1, B.) This prevents the ankle bending.

4. Wooden splint (constructed as in Fig. 1, A, and applied as in Fig. 3), reaching from the toes to the loin as the knee is fully flexed.

5. Block and tackle, capable of sustaining traction of at least five hundred pounds.

6. Loop of rope, long enough to reach from the sole above the flexed knee.

7. Cotton, sheet-wadding, plaster-of-Paris bandages, anæsthetics, etc.

(II) *Technic*.—1. Bandage the metal form to the well-padded foot and leg, at the same time catching the rope loop beneath the sole and at the sides of the leg.

2. Secure patient to the table by passing swath across the anterior superior spines, beneath table, up through one side of perineum, etc. This both holds the pelvis firmly to table, proximal fragment with it, and in passing over the perineum engages the neck of the femur, guarding it against a possible dislocation under strong traction.

3. Administer anæsthetic briefly, but to sufficient degree of relaxation.

4. Flex knee fully, a pad of sheet wadding being placed between calf and thigh, adjust the tackle, and the bridge shown in Fig. 2, "A."

* Read before the Syracuse Academy of Medicine, April 6, 1915.

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5. While an assistant makes traction, the tibia engaging the overhanging condyles, the surgeon steadies the leg and foot as in Fig. 2, gently jockeying the leg and with it the distal fragment through the rigid lateral ligaments of the knee, to assist the ends in clearing, and the distal fragment to mount into its place upon the proximal, when the ends should be gently but firmly ground together. (A fluoroscope is valuable though not indispensable.)

6. When the measurements are well adjusted, as shown by the measurements or the fluoroscope as traction is relaxed, they are guarded against redispacement while the metal strip is removed, the wooden splint and plaster applied as shown in Fig. 3, binding foot, leg, thigh, and pelvis together in one solid mass, though no dangerous nor uncomfortable pressure is necessary. When the dressing has hardened the patient is carefully returned to bed, pillows supporting the limb from falling sidewise.

In my experience, while each case must be judged alone, twenty days are usually sufficient in simple cases to warrant removal of the plaster dressing, and beginning the gradual straightening of the knee.

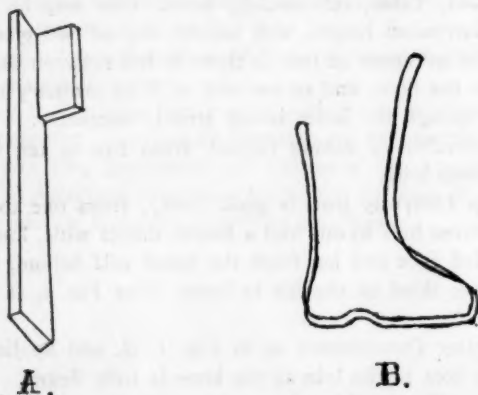


FIG. 1.—A, wooden splint, (for material see p. 289). B, iron strap foot and leg piece (for material see p. 289).

After removal of the plaster dressing, the patient is permitted to roll about in bed for a week or ten days, the injured member supported by padded splints bandaged on. About the second month crutches may be adopted, and weight bearing resumed as it may be done with entire comfort—a matter quite safely to be entrusted to the patient.

In cases of compound infected fracture, windows may be left in the plaster for drainage and counter-drainage, openings for which should be made between the wound and the trunk so as to facilitate drainage by gravitation.

(III) *Mechanics*.—The appended table shows the distances between the points of attachment of the muscles affecting the relations of the

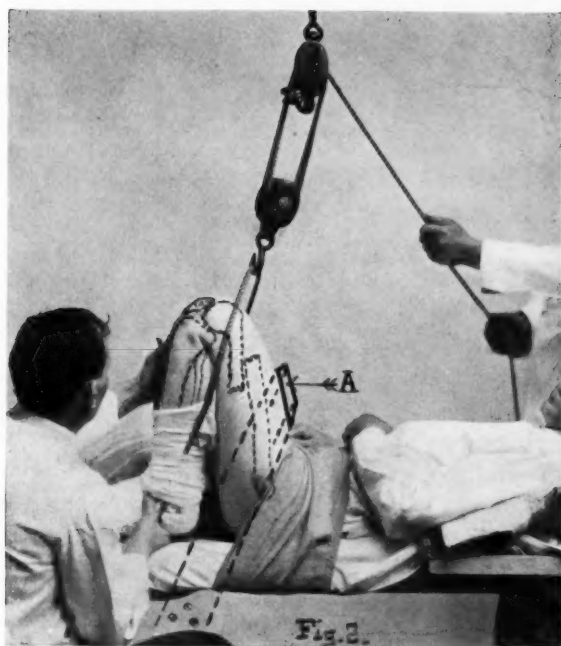


FIG. 2.—Author's method of applying extension.



FIG. 3.—Showing dressing applied after reduction of fragments.



FIG. 4.—Transverse fracture of femur before reduction ($4\frac{1}{2}$ inches overriding).



FIG. 5.—Fracture reduced.

EXTENSION OF TRANSVERSE FRACTURES OF THE FEMUR

fragments of a broken femur, in those combinations of flexion and extension of hip and knee commonly used in such cases, viz.: double extension (hip 180°-knee 180°), the Hodgens position (hip 45°-knee 45°), the suspension used in children (hip 90°-knee 180°), and the 90°-30° combination of this paper.

From the table it may be seen that in the 90°-30° combination of which advantage is taken in the method here under discussion, all the muscles involved are relaxed except three, viz., the gluteus maximus, the quadriceps extensor femoris, and the lower portion of the adductor magnus. The tightening of the gluteus maximus is wholly favorable, tending to hold the proximal fragment back; the slight tension of the quadriceps only enables it the better to serve as an anterior splint, preventing forward angulation and displacement at the site of fracture; the tension of the lower portion of the adductor magnus is increased, it is true, which would seem to be disadvantageous, but from the fact that the tendency to lateral displacement is only slight at most, the disadvantage cannot be great, and is easily counteracted by the intact leg bones serving as a splint to the broken femur, especially by virtue of the lateral rigidity of the knee-joint. On the other hand, the muscles which would seem to be most active in producing the classical displacement by which the proximal fragment is drawn forward and the distal fragment tilted backward and downward, viz., the thigh flexors, the upper adductors, the hamstrings, the gastrocnemius and popliteus, particularly the last two, are markedly relaxed.

	Hip 180° Knee 180°	Hip 45° Knee 45°	Hip 90° Knee 180°	Hip 90° Knee 30°
Psoas and iliacus.....	7	6½	5¾	5¾
Gluteus { Maximus.....	7	7½	7¾	7¾
Medius.....	5	5	5	5
Minimus.....	3	2¾	2½	2½
Pectineus.....	4½	4	3¾	3¾
Sartorius.....	19	18½	18	13½
Quadriceps extensor femoris.....	19½	19	17	20½
Gracilis.....	19	18½	18½	13½
Adductor { Magnus { Upper.....	5	4½	4	4
Middle.....	8½	8½	8	8
Lower.....	13½	14½	16	16
Longus.....	7	6¾	6½	6½
Brevis.....	6	5½	5	5
Semitendinosus and semimembranosus....	19	19½	22½	15
Biceps.....	17	18	20½	16
Gastrocnemius.....	18	17½	18	15
Popliteus.....	5	4¾	5	3

NOTE:—Black type figures denote increase of distance and tension.

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Should the ends become unseated now and then, the situation is quickly betrayed by the marked disparity of height between the two knees, as shown by measurements from anterior superior spines to the patellar level, or radiographs, the anæsthesia is so brief, and the shock so negligible, that the reduction may be repeated as often as may be required.

As shown by the illustrative radiographs (Figs. 4 and 5), the method seems to work well enough to warrant its recommendation to the profession for trial in those cases to which, according to the opening paragraph, it applies.

NOTES ON FRACTURES*

BY WILLIAM J. RYAN, M.D.
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THE following report is based on the "follow-up" records of 121 fractures treated in the Surgical Dispensary of the St. Agnes' Hospital, of Philadelphia, from February 1, 1914, to August 1, 1914, and in Dr. Müller's Clinic in the Polyclinic Hospital during 1914.

Seventy-four patients were traced, and, while we were disappointed in the limited scope of the investigation, certain details seem of interest.

	Total cases	Traced
Nose	3	0
Inferior maxilla	4	1
Zygoma	1	0
Ribs	6	3
Clavicle	10	6
Acromial process	1	0
Humerus	18	13
Radius	31	23
Ulna	7	4
Radius and ulna	6	4
Metacarpal	10	7
Phalanges of finger	6	3
Tibia	7	4
Fibula	7	4
Metatarsal	4	2
Total	121	74

One fracture of the inferior maxilla was heard from. This case had no disability or deformity but complained of occasional slight pain when exposed to cold.

Of 3 fractures of the ribs traced, 1 had died of pneumonia, and 2 had had pleurisy. They were all men over fifty. The pneumonia case died out of town and we could get no definite information regarding his illness. One of the cases of pleurisy was on the affected side. Examination a year after the injury revealed no deformity along the line of the fractured ribs.

Six cases of fractured clavicle heard from showed excellent functional results. Two of them, of twenty and thirty years of age, showed considerable callus formation. Fortunately, both were men.

Thirteen fractures of the humerus were traced; 2 of the upper end; 2 of the shaft; and 9 of the lower end. The first were both

* Read before the Philadelphia Academy of Surgery, April 5, 1915.

impacted fractures of the surgical neck. One man of forty-five, a bookbinder, is back at his regular employment. The other, a man of seventy-four, has good firm union but has considerable pain on forced flexion and internal rotation. Of the shaft fractures, 1, a four-year-old girl with a fracture below the insertion of the deltoid, has a perfect result, both anatomically and functionally. A man who had an oblique fracture at the middle of the shaft with 1 inch shortening has some bowing backward of the humerus, but no shortening, and the functional result is excellent. Nine fractures of the lower end were seen or heard from; 2 of the internal condyle; 5 of the external condyle; and 2 supracondylar. All were in children and all were due to falls on the elbow which makes the greater frequency of the fractures of the external condyle rather extraordinary. These were uncomplicated and all had good results. One supracondylar fracture has limitation of extension, but flexion is as good as in the other arm. This supracondylar fracture was accompanied by a fracture of both external and internal condyles, the line of fracture of both condyles converging as they extended downward. There was extreme swelling and extensive bleb formation, which delayed active treatment of the fracture for four days.

Radius.—Of 31 fractures of the radius, 23 were traced. These involved the upper end once, the shaft 4 times, and the lower end 18 times. The fracture of the upper end was a chip off the flange-like head. The case was a week old with a history of a fall on the hand which caused the elbow to bend, and the back of the forearm came in contact with the ground. Jones's position gave an excellent result, there being no impairment of motion in the elbow, nor interference with pronation and supination.

Four fractures of the shaft were traced, 3 being transverse cracks without displacement, and 1 oblique fracture about 4 inches from the lower end of the radius. The obliquity was from behind downward and forward. The functional result in this case was only fair, there being some interference with supination six months after the injury, due to failure of the patient to keep up his massage treatment. He returned again for massage and now has almost complete power of supination.

Eighteen of 23 fractures of the lower end were traced. Sixteen were within $1\frac{1}{2}$ inches of the lower end, and 2 were fractures of the anterior edge of the articulating surface. Seven of the 23 fractures showed the classical silver fork deformity, the latter varying in degree. All 7 were accompanied by a fracture of the styloid process of the ulna. These were treated with anterior and posterior straight splints,



FIG. 1.—Fracture of jaw, of three months' duration before treated. Anatomical and functional results good. Some pain in damp weather.

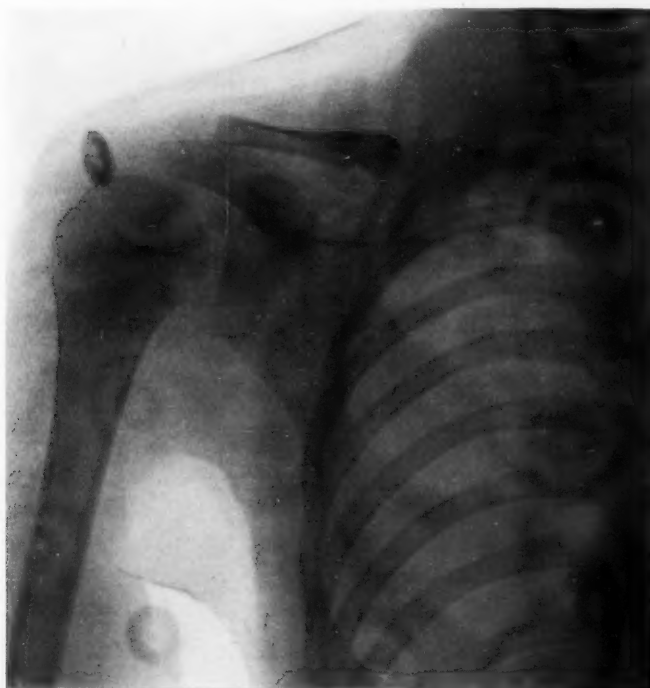


FIG. 2.—Fracture of middle of clavicle. Three weeks old on admission.



FIG. 3.—Male patient, aged seventy-eight. Fracture of upper end of humerus and surgical neck; fracture of head including greater tuberosity. Result: good union; fair function; pain on extreme flexion and extension.



FIG. 4.—Fracture of upper end of shaft of humerus. Excellent result both anatomically and functionally.

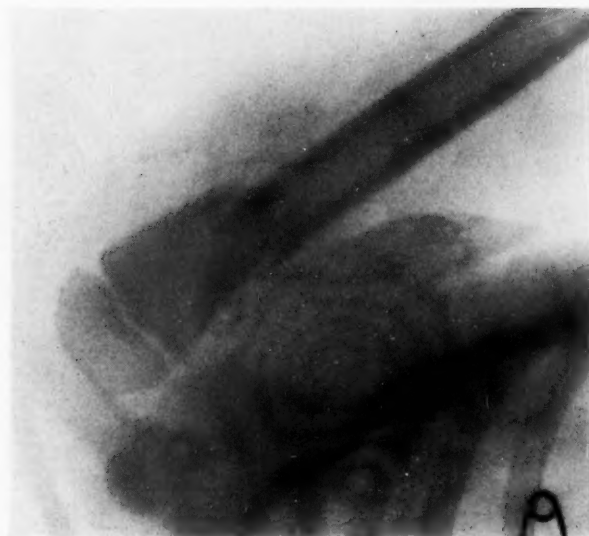


FIG. 5.—Fracture of surgical neck of humerus. Anatomical and functional results excellent.



FIG. 6.—Fracture of lower end of radius; comminuted fracture of styloid of ulna. Anatomical result: slight bulging in front of wrist; functional result good.

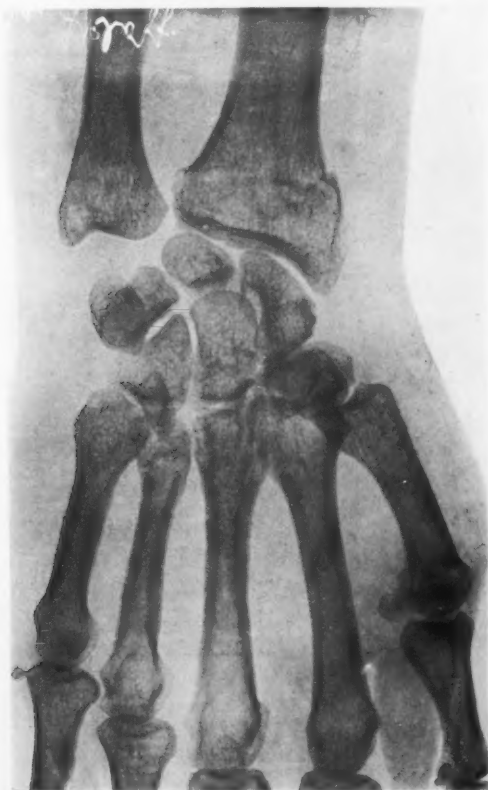


FIG. 7.—Impacted fracture of lower end of radius.



FIG. 8.—While playing, fell from top step, striking pavement with hand outstretched. Examination disclosed backward bending of forearm about two inches above wrist. Anterior and posterior straight splints in position midway between pronation and supination. This plate taken after first attempt at reduction. This plate illustrates the case in which the upper fragments were split and in which the upper ends of lower fragments were caught in the split. See text, page 295.

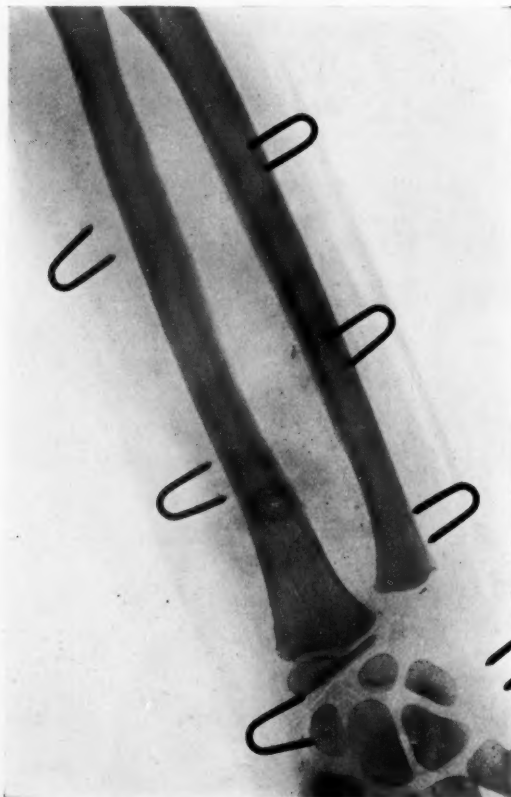


FIG. 9.—Greenstick fracture, of both bones of the forearm. Result excellent.

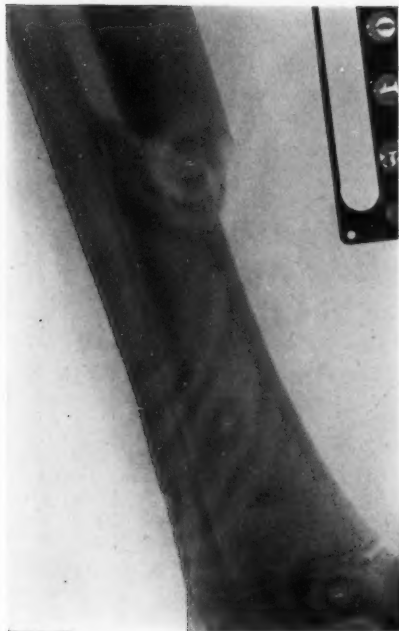


FIG. 10.—Fracture of shaft of tibia, treated by extension and plaster cast. Anatomical result: slight prominence of lower end anteriorly; functional result excellent.



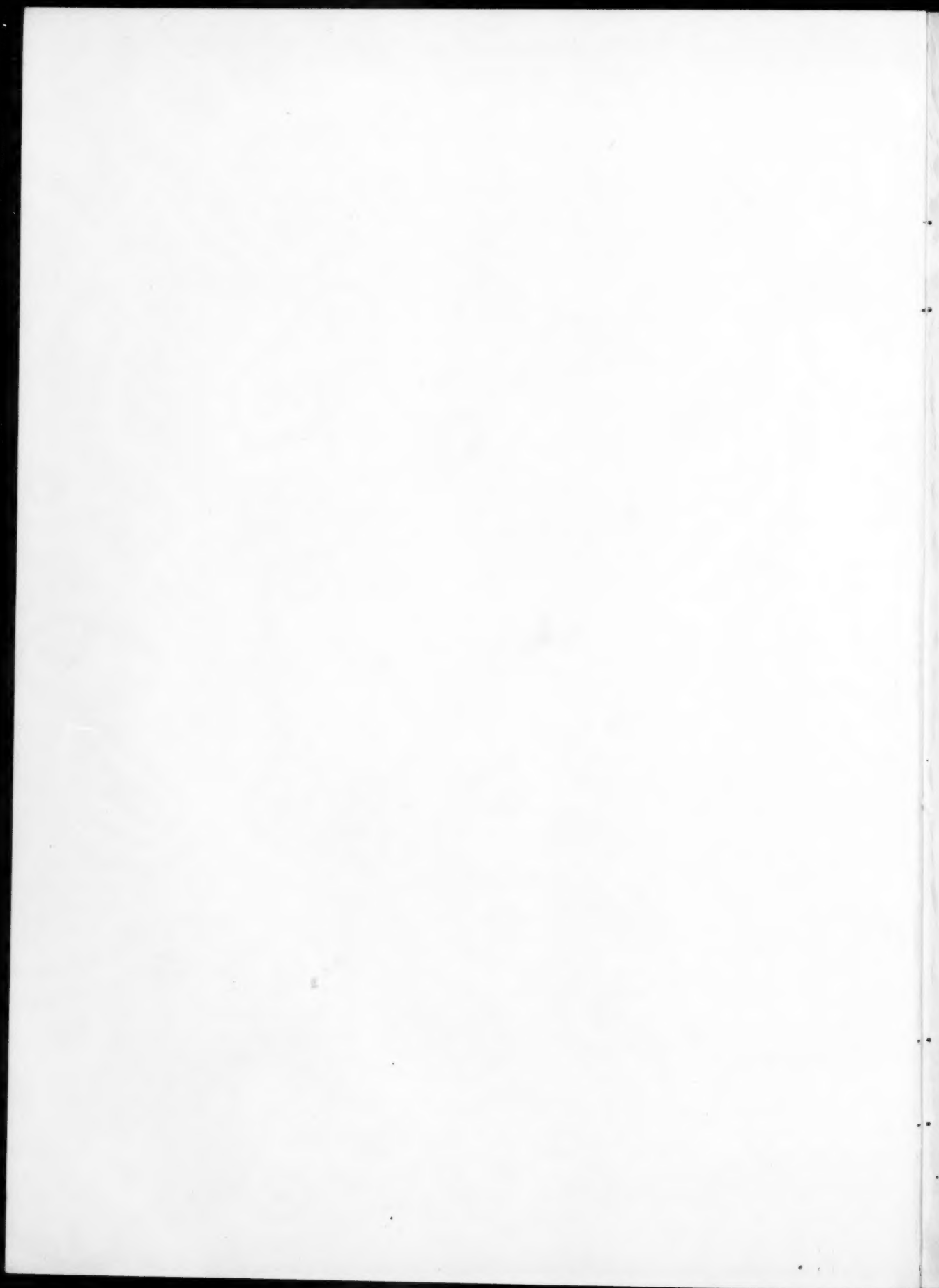
FIG. 11.—Fracture of both bones of the leg; considerable comminution. Functional result fair, there being some stiffness of flexion.



FIG. 12.—Comminuted fracture of lower end of fibula.



FIG. 13.—Comminuted fracture of first metatarsal with fracture of proximal phalanges of first and second toes.



NOTES ON FRACTURES

the posterior being notched to keep from pressing on the prominent lower end of the ulna. All gave good functional results, but in all 7 there was a loss of the prominence of the lower end of the ulna. This alteration was not present in the following 9 cases, which were treated with a Bond splint. Seven were transverse fractures of the radius with little or no displacement, and 2 were epiphyseal separations. All have good functional and anatomical results.

I might remark here that 3 cases of this year's series with marked deformity and accompanied by fracture of the styloid of the ulna were treated with a Bond splint and, six weeks to two months after the injury, show no loss of prominence of the lower end of the ulna.

The two Barton's fractures were treated with anterior straight splint and have good functional results.

Ulna.—Of the 7 fractures of the ulna, 4 were traced; 2 of the olecranon, 1 of the shaft at the junction of the lower and middle third, and 1 of the styloid. All were simple and showed good results.

Radius and Ulna.—Four out of 6 were traced. Two were complete of both bones, with considerable displacement; 1 a girl eight years of age and 1 a woman of forty. One was greenstick of both bones, and 1 was a complete fracture of the radius with a greenstick of the ulna, the type reported by Dr. Skillern before this Academy last year.

The fracture in the young girl was difficult of reduction because both lower fragments were split longitudinally about 1 inch, and the upper fragments wedged loosely in the split, the fracture occurring about 3 inches above the wrist. It was successfully reduced though and she has a good result both functionally and anatomically.

The result of the fracture in the woman is bad. She was struck on the back of the arm by a heavy poker, and on admission her forearm was sharply angulated at the junction of the lower and middle third. X-ray showed both lower fragments to be badly comminuted with encroachment by the radial fragments on the interosseous space. Plating was advised, but she refused, and we attempted to mould the fragments into position without much success. She has fairly good motion in her wrist but she can not completely close her fingers. Pronation and supination are also limited. There is slight bowing backward of both bones.

The greenstick fracture of both bones was simple and gave a good result. The case of Skillern's fracture has an excellent result. At the time of admission there was some backward angulation but we were able to reduce it without making the greenstick fracture of the ulna complete. All these cases were treated in full supination.

WILLIAM J. RYAN

Metacarpal.—Seven cases were heard from; 1 of the first, 4 of the second, and 2 of the fifth. All were accompanied by great swelling. The fracture of the first involved the head and extended into the joint. Dressing in full abduction and early massage gave a good result. The other 6 were simple without displacement and have excellent results.

Fractures of the phalanges were simple and uncomplicated and need only be mentioned.

Tibia.—Four cases of fracture of the tibia were heard from. One of these cases was very interesting. The patient was a boy, ten years of age, who while running struck his leg against a sharp spike of an iron fence which had been bent outward towards the sidewalk. Close examination of the lacerated wound showed that a groove had been made in the antero-external surface of the tibia about $\frac{1}{4}$ inch deep and about 1 inch long. There was no evidence of other fracture and a careful röntgenogram showed no fracture other than the groove. The other 3 cases were in children: 2 greenstick and 1 spiral fracture which was easily reduced. Plaster cast was used in these 3 and they have excellent results, all being able to run and play as before.

Fibula.—Of 7 fractures of the fibula 4 were heard from. Three were Pott's fractures without involvement of the internal malleolus. Two were treated in the house in the usual manner and discharged in a week to return to the surgical dispensary. One was ten days old on admission and a plaster cast was applied in dispensary. The fourth case was at the junction of the upper and middle thirds and was caused by the kick of a horse. There was displacement backward of the lower fragment about $\frac{1}{2}$ inch. After reduction a plaster cast was applied from the toes to the middle of the thigh. This man has now a hypertrophic arthritis of the knee of the injured leg, though X-ray at the time of injury showed nothing abnormal in the knee.

Metatarsal.—Two fractures of the first metatarsal were heard from. Both were in the middle of the bone and were due to the fall of a heavy weight on the foot. One was accompanied by a fracture of the first and second proximal phalanges. It was greatly comminuted, the bone really being smashed; the other, by the first and second proximal and the third distal phalanx. In both there was entrance swelling and ecchymosis which required small incision. In first no displacement occurred. In the second there was angulation toward palmar surface. Both cases were treated with a moulded binder's board splint and a wide bandage over instep. (The functional result of the first is good, but the other case has to wear an arch support to relieve pain.)

ON FRACTURES OF THE SESAMOID BONES OF THE THUMB*

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THE following case represents the fourth example of fracture of a sesamoid bone of the thumb to be recorded in the literature.

E. B., male, white, aged twenty-six years, civil engineer, reported at the Surgical Out-patient Department of the University Hospital (Case record 61996) on March 2, 1915, with the history of having fallen three days previously in such manner that the left thumb was traumatized against the granite Belgian block pavement.

This hand had never been injured previously. Clinical examination revealed moderate swelling of the left thumb, ecchymosis along the thenar eminence, and "wincing" tenderness both at the head and at the base of the first metacarpal. A clinical diagnosis was made of a "chipping" fracture of the metacarpal head. Skiagram (Fig. 1) revealed a fracture of the ulnar sesamoid bone opposite the head of the first metacarpal, the smaller fragment being separated distally, and there being a definite, dentate line of fracture. There was also an oblique fracture at the base of the metacarpal, separating the ulnar corner and entering the carpo-metacarpal joint at its middle. The thumb was immobilized in extension and slight abduction by a spica sodium silicate bandage.

Re-examination after the reading of the skiagram brought out two additional facts. In the first instance, the patient was loose-jointed, and could hyperextend both thumbs normally at the metacarpo-phalangeal joint. In the second place, there was definite "wincing" tenderness, localized to the ulnar sesamoid bone. After four weeks the immobilizing dressing was removed, and massage instituted.

While the clinical diagnosis of "chipping" fracture of the metacarpal head was inaccurate, yet it was close enough to lead to the detection of the fracture of the sesamoid bone. In order to parry the question of a congenitally bipartite sesamoid, a skiagram of the right thumb was taken (Fig. 2), but no abnormality of the sesamoids was revealed. This fact, together with the history of a fall upon the thumb, the clinical localization of "wincing" tenderness to the sesamoid, shown

* Read before the Philadelphia Academy of Surgery, April 5, 1915.

involved by the skiagram, and the dentate line of the fragments in the skiagram contrasted with the smooth line of a bipartite sesamoid, points to a fracture.

The other three cases were found only in the German literature.

The first case was reported by Preiser, in 1907 (*Aerzt. Sachverstaendigen-zeitung*, 1907, No. 19, S. 400). The patient was a woman, aged thirty years, who had fallen upon the right hand, fracturing both of the sesamoids of the thumb.

The second case was observed by Morian, in 1905, but not reported until two years later, nor published until 1909 (*Deutsch. Zeitschr. f. Chirurg.*, 1909, H. 102, S. 394). The patient was a man, aged twenty-seven years, whose right thumb was caught between a closing door and the jamb. Skiagram revealed a comminuted fracture of the ulnar sesamoid bone.

The third case was presented by Maas, in 1912, in an inaugural dissertation entitled: "Ueber Sesambein-Frakturen" (*Emil Ebering*, Berlin, 1912, 18pp.), which reviews the subject and gives references to the literature, and which is the latest article that could be found at the time of preparation of this paper. The patient was a man, aged fifty-three years, a wheelwright by trade, who was struck upon the left thumb by the end of an unfinished metal tire. The skiagram Maas shows reveals a fracture very similar to that in my case, and involving the ulnar sesamoid bone. In this case the tire was grasped between the thumb and the index finger, resting upon the ulnar sesamoid bone, which was thus directly exposed to trauma. Skiagram of the right hand showed a normal state of the bones.

As to the nature of the violence that produced the injury, whether direct or indirect, it is difficult to decide, for the mechanism of the fall was such that the one could operate as well as the other, and arguments could be brought forth in favor of either form. The absence of comminution of the fragments, and their similarity in the skiagram to fractures produced experimentally by indirect violence, however, lead one to conclude that the latter variety of violence was effective. The three previously reported cases, on the contrary, were due to *direct* violence. But Morian criticises Preiser for rejecting indirect violence as the cause of the fracture in his patient, who, like mine, also fell upon her outstretched thumb.

Experimentally, fractures have been produced by both forms of violence. Preiser obtained results by direct violence, but could produce none by indirect violence. Morian found it easy to procure fractures by direct force, and then made eight attempts to secure fracture by indirect force, in five of which he succeeded. Of these five, in four both bones were broken. (compare Preiser's case), while in the fifth the ulnar alone was involved. In all, the line of fracture was transverse or oblique, and a small fragment was separated as often proximally as



FIG. 1.—Fracture of ulnar sesamoid bone of thumb. Fracture of base of first metacarpal bone.

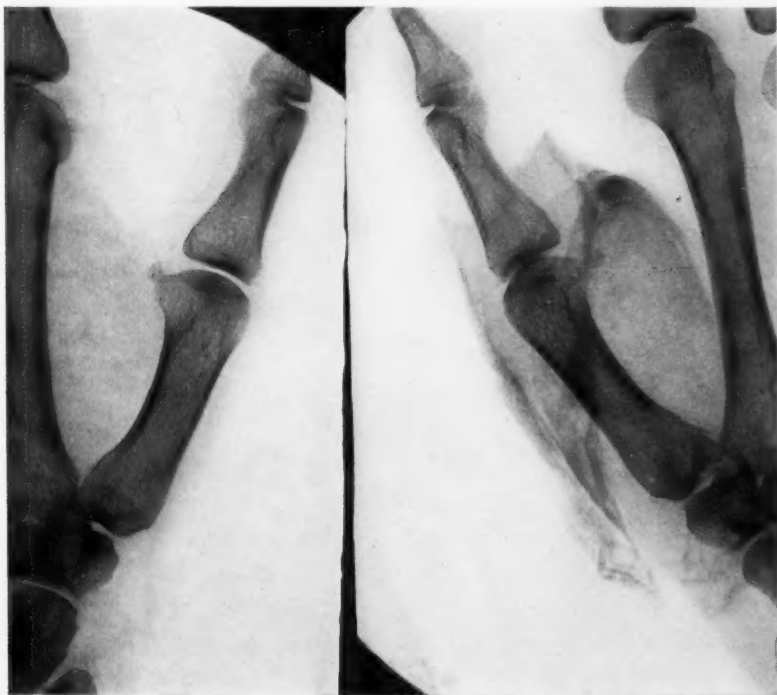


FIG. 2.—Same as Fig. 1. The normal right thumb is shown for comparison.



FRACTURES OF THUMB SESAMOIDS

distally with one exception, a radial sesamoid that was broken through the middle. Clinically, fractures by indirect violence, as obtains in fractures of the patella from a similar cause, are associated with more extensive laceration of the capsule of the joint.

In an attempt to clarify the subject I examined 22 thumbs in the Anatomical Laboratory, some of the results of which are shown in the cuts (Figs. 3 to 9). The first sketch (Fig. 3) shows the normal sesamoids *in situ*. The radial is typically larger and oval, and the ulnar smaller and round, and situated more distally. Both rest upon, or close to, the anterior border of the base of the proximal phalanx.

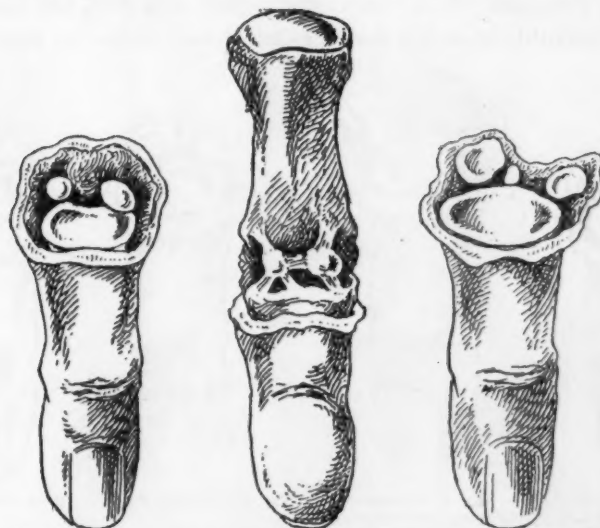


FIG. 3.—Dissection showing normal sesamoids of thumb *in situ*. Radial is large and oval; ulnar is small and round.

FIG. 4.—Dissection showing ligaments connected with sesamoids. One intersesamoid; two radial; three ulnar.

FIG. 5.—Dissection showing bipartite radial sesamoid. Note smooth, even edge.

Both are embedded in the capsule, receive insertions of muscles from the thenar eminence, and form a groove through which passes the long flexor tendon.

The second sketch (Fig. 4) demonstrates what I have been unable to find any description of, namely, definite ligaments connected with the sesamoids, aside from that which binds the two bones together. In this specimen five definite capsular thickenings were found, of which two were associated with the radial, and three with the ulnar, sesamoid. These recall in miniature the picture of the patella with its quadriceps tendon and ligamentum patellæ, and the effect of sudden, forcible hyperextension upon the sesamoids seated upon the border of

the phalanx is fairly comparable with the patella resting upon the trochlea of the femur when subjected to similar strain. Instead of the ligament itself tearing it avulses a shell of bone, as in any other tear fracture.

The third sketch (Fig. 5) shows a congenital division of the radial sesamoid: a similar condition of the same bone was also found by Preiser in his experimental investigations. Morian saw clinically a like state of the ulnar sesamoid in a patient whose daughter had a congenitally-cleft sesamoid of the great toe. But for the following points of differentiation, as emphasized by Stumme, one might be deceived by diagnosing fracture. In a congenitally-cleft sesamoid the components possess a smoothly-rounded and regular shape, while the fragments of



FIG. 6.—Dissection showing tear-fracture of ulnar sesamoid experimentally produced.

FIG. 7.—Dissection showing tear-fracture of radial sesamoid experimentally produced.

FIG. 8.—Same as Fig. 6. FIG. 9.—Same as Fig. 6.

a broken sesamoid show an irregular, dentate edge on the side that corresponds to the line of fracture.

The remaining sketches (Figs. 6, 7, 8 and 9) show a series of tear-fractures. Each specimen was prepared as follows: The thumb was disarticulated at its junction with the carpus. The muscles were removed without disturbing the joints. The metacarpal bone was fixed in a vise, and with a wooden mallet a blow was struck upon the front of the thumb near its tip. Not always did the sesamoid fracture, however. In some cases the phalanx, in others the metacarpal broke into or near the joint. But of the breaks obtained the four shown are fairly typical of what one might expect in the living. In these four cases the ulnar sesamoid yielded three times (Figs. 6, 8 and 9) and the radial once (Fig. 7). In no instance were both sesamoids broken.



FIG. 10.—Hand showing a complete set of ten sesamoids opposite the metacarpal heads. An additional sesamoid is seen opposite the head of the proximal phalanx of the thumb.

FRACTURES OF THUMB SESAMOIDS

The removal of the muscles showed that they play no part in the fracture.

Failure to detect a fractured sesamoid might be regarded as an inconsequential matter, but it must be remembered that the thumb is a very highly-specialized digit, capable of delicate and intricate movements, and that its crippling might be an affair of serious moment to a wage-earner.

The treatment is by immobilization in a neutral position, and for this purpose a sodium silicate dressing, left undisturbed for four weeks, fulfils all indications. It must not be forgotten that the sesamoid, like the scaphoid, is bathed by synovial fluid, and therefore heals slowly.

As to the remaining fingers, the sesamoid bones are inconstant. Citing Pfitzner, Dwight (*Variations in the Bones of the Hands and Feet*; Philadelphia, J. B. Lippincott Company, 1907, p. 11) tabulates the findings in 1440 adult hands as follows:

	I	II	III	IV	V
R.....	99.9	48.7	1.4	0	2.1
U.....	100	0.1	0	0.1	82.5

In his thesis, Maas evidently overlooked this table of Pfitzner's, for he states that the radial sesamoid of the middle finger has never been observed. According to the table, the ulnar sesamoid of the middle finger and the radial sesamoid of the ring finger were not found. I chanced upon a skiagram that shows the complete set of ten, and an additional sesamoid opposite the distal interphalangeal joint of the thumb (Fig. 10). Pfitzner has observed congenital division of the ulnar sesamoid of the little finger, as well as of the radial sesamoid of the index. I have found no instance of fracture of the sesamoid bones of the fingers, but it is quite probable that examples will be reported in the future.

ARTHROPLASTY OF THE ELBOW*

BY ASTLEY PASTON COOPER ASHHURST, M.D.

OF PHILADELPHIA

I HAVE adopted arthroplasty of the elbow-joint in five patients: twice for bony ankylosis, and three times for marked limitation of motion following fracture.

TECHNIC OF THE OPERATION.—1. *Exposure of the Joint.*—The skin incision (Fig. 1)¹ begins on the external supracondylar ridge of the humerus, about 5 cm. above the joint, and is continued straight downward to the joint level where it is curved slightly backward toward the extensor surface of the forearm; its entire length is about 10 cm. This incision is carried down to the supracondylar ridge above the joint; below the joint level the deep fascia is exposed but is not incised. The soft parts are then cleared from the humerus: the brachioradialis and the extensor carpi radialis longior are displaced forward and the triceps backward, *thoroughly* exposing the external condyle, the anterior capsule of the joint, and the external lateral ligament with the origin of the extensor muscles (Fig. 2). The external condyle is then detached from the humerus by osteotome, the bone section entering the elbow-joint on the capitellar surface of the humerus. In most cases even when the ulno-humeral joint is ankylosed the radio-humeral joint is free, and the external condyle may be easily turned downward on the external lateral ligament as a hinge, exposing the joint (Fig. 3). If ankylosis is present between the radius and humerus it is easy to separate them by gouge without injury to the external lateral ligament. In order to turn the condyle downward sufficiently to expose the joint thoroughly, the capsule must be snipped with scissors in front of and behind the external lateral ligament.

2. *Dislocation of the Joint.*—If ankylosis exists between the ulna and humerus these bones are separated by a suitably shaped gouge, driven transversely across the joint by smart blows from a hammer. When the union has been almost completely divided, the remaining fibres on the inner side of the joint may be ruptured by abrupt, short, forceful movements of flexion and extension applied to the elbow-

* Read before the Philadelphia Academy of Surgery, April 5, 1915.

¹ The accompanying illustrations (Figs. 1 to 10) are from photographs of preparations in the Laboratory of Operative Surgery in the University of Pennsylvania.

ARTHROPLASTY OF THE ELBOW

joint. If one fears injury to the ulnar nerve a small incision may be made over its course between epitrochlea and olecranon, and the nerve may be drawn away from the bones. Only in one case did I find this necessary.

Ankylosis having been overcome, or in cases where no ankylosis is present, the elbow-joint is dislocated by adducting the forearm around the internal lateral ligament, as a hinge, until the forearm lies almost parallel with the upper arm, causing the ends of the humerus, radius and ulna to come into full view (Fig. 4).

3. *Shaping the Bone Ends.*—As little as possible is done to the ulna, especially when the head of the radius is healthy. Reliance is placed on resection of the humerus for shaping the new joint (Fig. 5). If ankylosis exists in the upper radio-ulnar joint it is simpler to resect the head of the radius than to turn in a flap between radius and ulna. For shaping the humerus a Gigli wire saw mounted in a bow-shaped frame (the saw of Pierre Delbet) is the most convenient instrument; with this a series of cylindrical sections can be removed from the humerus until enough room is secured between the bone ends. Seldom is it necessary to remove any bone above the level of attachment of the internal lateral ligament at the base of the epitrochlea.

4. *Interposition of the Flap.*—The bones being temporarily restored to their normal relations, the original skin incision is extended backward from its upper end across the posterior surface of the arm (Fig. 6). The triangular skin flap thus outlined is raised, including a fair amount of subcutaneous fat, until the superficial surface of the triceps, or of the fat and fascia covering it, is fully exposed. An interposing flap of fat and fascia is then raised from the superficial surface of the triceps, with its base at the olecranon (Fig. 7). It is best to include some of the triceps aponeurosis and muscular fibres in this flap. The elbow-joint is then partially dislocated again, and the flap is attached to the internal lateral ligament of the elbow, and to the anterior and posterior capsules of the joint, by a few interrupted sutures of chromicized catgut (No. 0), thoroughly covering the articular surface of the humerus (Fig. 8).

5. *Closure of the Wound.*—The forearm is restored to its normal relation with the arm, and the external condyle is brought up in front of the pedicle of the interposing flap, and is fixed to the humerus (Fig. 9). For this purpose I prefer Lambotte's self-boring screws; in the accompanying illustration a nail was employed because at the time (in the Laboratory of Operative Surgery) no such screws were at hand. I have also used chromic gut and phosphor bronze wire

sutures, but have found them inferior to the Lambotte screws in obtaining secure fixation. Two screws are better than one. If much bone has been removed from the humerus, it will be necessary to trim the external condyle to fit.

The triceps is then sutured accurately to the brachioradialis and extensor muscles, the deep and superficial fasciæ are accurately approximated, and finally the skin wound is closed (Fig. 10). No drainage is necessary. Interrupted chromic gut sutures (No. 1 or No. 2) are employed throughout. Rarely is a single ligature required.

The average time I have consumed in the operation is about one hour and thirty minutes.

CASE HISTORIES

CASE I.—Malunion of fracture of external condyle; limited motion and cubitus varus. James W., aged five years. Treated in Dr. Frazier's service at the Episcopal Hospital. Fractured the external condyle of his right humerus in July, 1908; and first came under my care in October, 1908, for limited motion (50 to 145 degrees) and cubitus varus (200 degrees). A skiagraph showed a fracture with outward rotation of the external condyle, but bony union. For six weeks subsequently light massage and passive movements were employed, but the range of motion improved only 10 degrees in flexion (40 to 145 degrees). Fig. 11 gives a photograph taken before operation.

Operation (November 18, 1908).—Usual external incision. Enough of the external condyle was removed (without detaching it from the humerus) to permit full extension of the elbow, as well as to overcome the cubitus varus. The olecranon fossa on the posterior surface of the humerus was also deepened. A fatty fascial flap from the superficial surface of the triceps was turned in over the denuded external condyle and the wound closed. The elbow was dressed in hyperflexion.

At the first dressing, ten days later, the wound was healed and the skin sutures absorbed. Motion was free and painless from 45 to 90 degrees. The arm was now carried in a sling. On December 5 there was motion from 40 to 140 degrees.

In May, 1912, three years and a half after operation, the boy was presented at a meeting of the Philadelphia Academy of Surgery, exhibiting perfect function, no varus deformity, full flexion, but extension only to 150 degrees (ANNALS OF SURGERY, 1912, ii, 647). Fig. 11 shows photographs made in March, 1915, more than six years since operation.

CASE II.—Malunion of fracture of lower end of humerus; limited motion and cubitus varus. William G., aged eighteen years.

ASTLEY PASTON COOPER ASHHURST

Treated in Dr. Harte's service at the Orthopædic Hospital. Referred by Dr. E. H. Kistler, of Lansford, Pa. When three years old this boy had fallen out of bed, landing on his left elbow. He recovered with Volkmann's contracture of the forearm, cubitus varus, and limited motion in the joint (40 to 110 degrees). When first seen, August, 1912, the Volkmann's contracture caused him no inconvenience, but the limited extension in the elbow was a serious handicap in his work in the mines, and his elbow was weak from the varus deformity and pained him if he used it much. Photographs made before operation (Fig. 12) show the distortion of the bony points at the elbow and the limit of extension (\times indicates head of radius; the condyles and the olecranon are indicated by dots).

Operation (September 2, 1912).—Through the usual external incision the head of the radius, which projected far backward (Fig. 13), was exposed posterior to the external lateral ligament, and was excised. The external condyle was then detached, the joint luxated, and a curved section was removed from the humerus, with Butcher's saw, much more bone being removed from the radial than from the ulnar side of the humerus, so as to overcome the varus deformity. Fig. 14 shows the portions of bone removed, that from the humerus having been removed in three sections, until the sawn surface fitted the ulna and the varus deformity was abolished. A flap of aponeurosis and muscle was secured from the triceps in the usual way. The epicondyle was re-attached to the shaft of the humerus with chromic gut. A drainage tube was placed at each end of the incision. The tubes were removed after three days. It was not necessary to have employed them. The arm was dressed on a straight anterior splint, at an angle of 160 degrees.

September 5: Motion from 90 to 135 degrees is easy.

September 19: Out-patient. Sinuses (resulting from unnecessary use of drainage tubes) have healed. Motion 90 to 160 degrees is easy. He carries his arm in a sling.

October 3: Motion 65 to 135 degrees. Ordered massage and light passive movements three times weekly.

October 17: Treatment discontinued. Motion 65 to 160 degrees. Returns to work.

July 31, 1913: Eleven months after operation the patient was again photographed (Fig. 12), to show the range of motion (40 to 170 degrees). There was no cubitus varus and perfect function. The elbow is stable. He works on a breaker engine at the mines.

CASE III.—*Bony ankylosis from metastatic arthritis.* Gertrude T., aged twenty-three years. Treated in Dr. Harte's service

at the Orthopædic Hospital. In May, 1912, when about seven months pregnant, but without any evident cause (such as preceding tonsillitis, influenza, vaginitis, etc.) this patient developed an acute polyarthritis and was confined to bed for seven weeks. The pregnancy terminated normally after convalescence, but the left elbow and right knee were ankylosed. When first seen at the Orthopædic Hospital, in March, 1913, about ten months after this attack of arthritis, the elbow was fixed in bony ankylosis at an angle of 110 degrees; fortunately the radio-humeral joint and the upper radio-ulnar joint were not involved, as rotation in the forearm was normal.

Operation (May 1, 1913).—Arthroplasty of elbow by usual technic. A small incision was also made over the ulnar nerve and this was drawn away from the internal condyle until the bone ends were properly shaped. Flap obtained from triceps as usual, and epicondyle reattached to humerus by wire suture. No drain. Dressed on internal right-angled splint.

May 12: First dressing. Inner incision healed; outer incision healed all but one spot, between two sutures at upper end, over the cavity resulting from cutting the triceps flap. A little serous ooze occurred at this point. Motion of 30 degrees free and painless. Can get hand to mouth. Arm carried in sling.

May 15: Motion from 70 to 120 degrees without pain. Rotation in forearm normal. Can put hand to back of neck.

May 23: Passive motion from 65 to 160 degrees without pain. Active movement from 70 to 120 degrees. Arthroplasty of the knee was done to-day (*Trans. Coll. Phys. Phila.*, 1914, xxxvi, 236), and on this account the patient had to remain in the hospital longer. Fig. 15 shows the condition on admission, and Figs. 16 and 17 show respectively the limits of flexion and of extension in elbow and knee three months after operation. Figs. 18 and 19 are from skiagraphs made before and after arthroplasty of the elbow.

October 17, 1914: Eighteen months after operation there was motion in the elbow from 45 to 150 degrees, there was active power of extension in the triceps, and the joint was quite stable. She does all her own housework, and finds it a very useful arm.

CASE IV.—Malunion of fracture of lower end of humerus, with limited motion. Benjamin F., aged fourteen years. Treated in Dr. Ashhurst's Orthopædic Service at the Episcopal Hospital. In the summer of 1912 this boy fell on his elbow and sustained a fracture-dislocation of the type Posadas (diacondylar fracture of the humerus with forward displacement of the lower fragment and posterior dislocation of both bones of the forearm). Neither the fragments of the humerus nor the dislocation of the elbow had been reduced, and 16 months later the boy applied to the



FIG. 1.—Arthroplasty of elbow; skin incision.

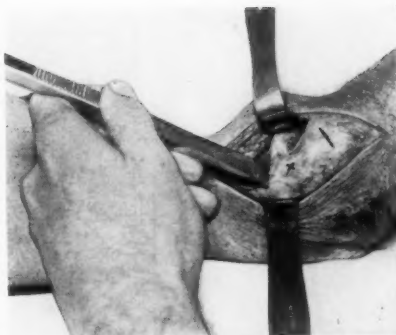


FIG. 2.—Arthroplasty of elbow; external condyle (X) and head of radius (—) exposed, and osteotome applied to external condyle.



FIG. 3.—Arthroplasty of elbow; external condyle turned down, exposing joint.



FIG. 4.—Arthroplasty of elbow; joint luxated around internal lateral ligament as a hinge.

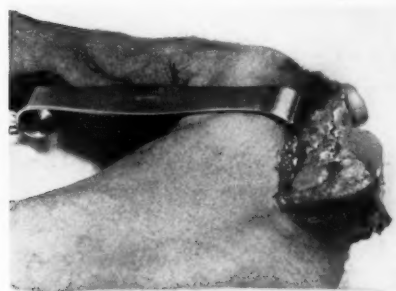


FIG. 5.—Arthroplasty of elbow; articulating surface of humerus removed with saw. Joint is viewed from outer side; the external supracondylar ridge and the surface from which the external condyle has been detached face the reader, and the joint surface of the humerus (freshly sawn) is directed toward the right of the picture.



FIG. 6.—Arthroplasty of elbow; bones replaced; dotted line indicates extension of primary skin incision, to expose triceps.



FIG. 7.—Arthroplasty of elbow; fat and fascia pedicled flap cut from surface of triceps.

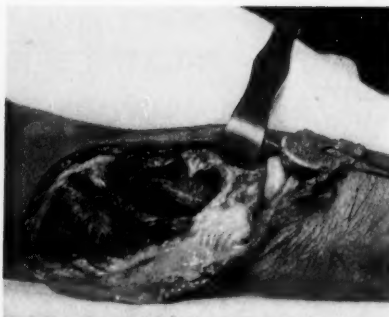


FIG. 8.—Arthroplasty of elbow; flap turned into joint covering articular surface of humerus. Same view of joint as Fig. 6.



FIG. 9.—Arthroplasty of elbow; external condyle has been replaced and fastened by a screw or nail.



FIG. 10.—Arthroplasty of elbow; skin sutured.

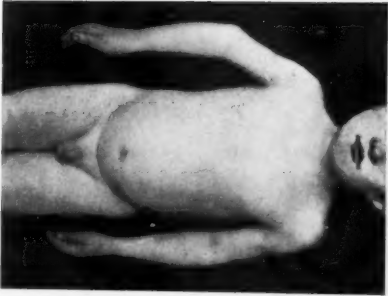


FIG. 11.—Case I. ^A ^B ^C *A* is a photograph taken in 1908, just before operation, showing cubitus varus. *B* and *C* are photographs taken in 1913, showing restoration of carrying angle and limits of extension and flexion.

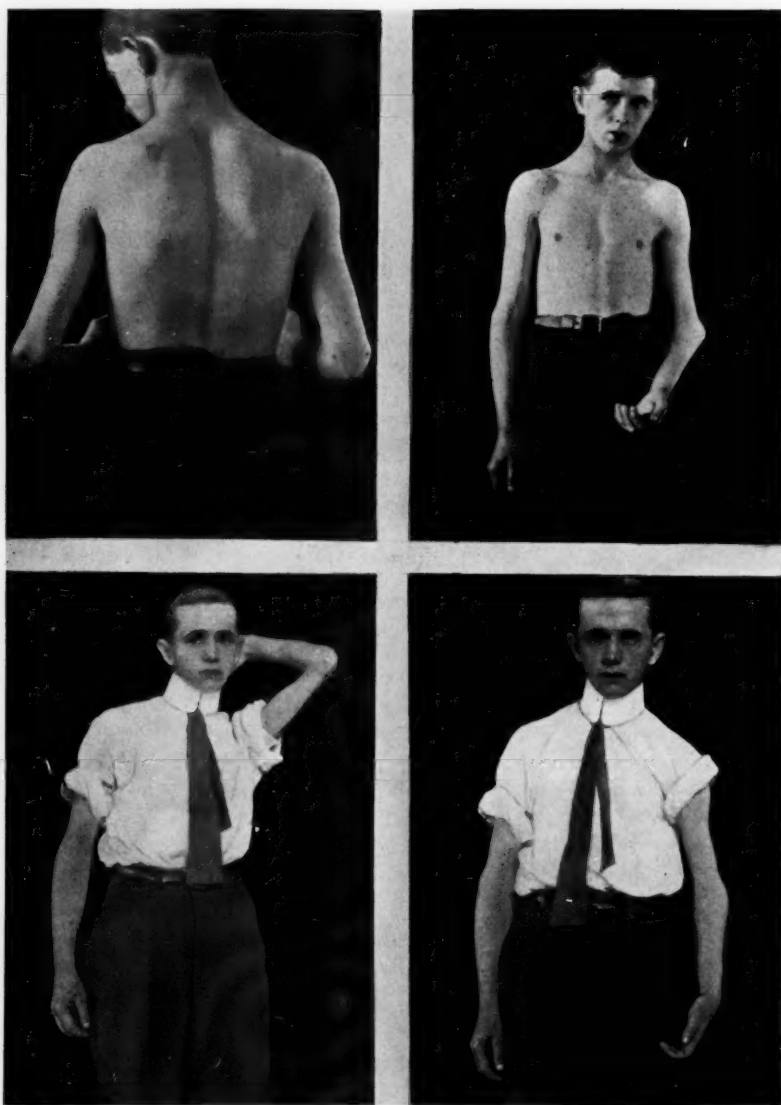


FIG. 12.—Case II. The first two photographs were made before operation, showing distortion of bony landmarks (X indicates head of radius) and limit of extension. The other two photographs were made eleven months after operation, showing range of flexion and extension, and restoration of carrying angle.



FIG. 13.—Case II. Skiagraph before operation, showing marked cubitus varus and limitation of extension.



FIG. 14.—Case II. Arthroplasty of elbow; portions of humerus and head of radius excised (September, 1912).



FIG. 15.—Condition of Case III on admission.



FIG. 16.—Showing amount of possible flexion in Case III on discharge.



FIG. 17.—Showing amount of extension possible in Case III on discharge.

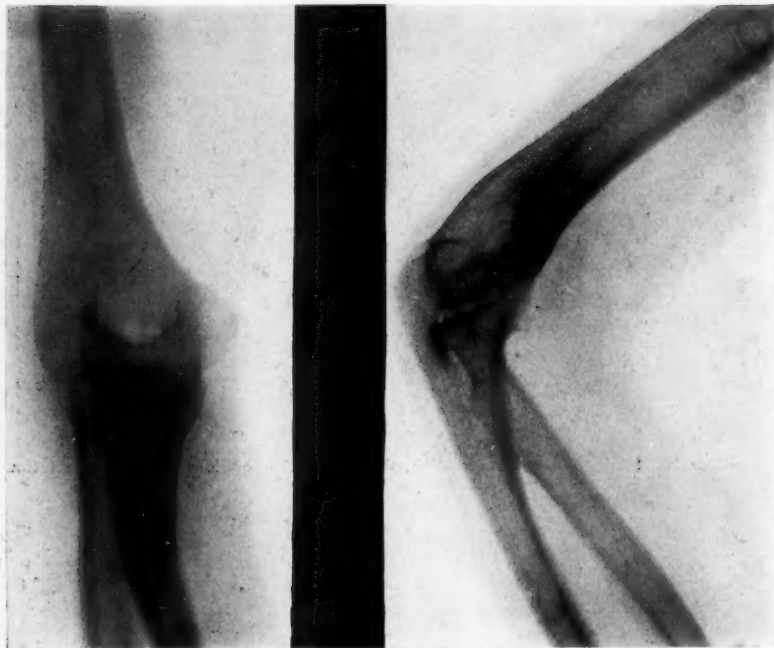


FIG. 18.—Case III. Skiagraphs showing ankylosis of elbow before arthroplasty.



FIG. 19.—Case III. Result of arthroplasty. From skiagraph seven weeks after operation.

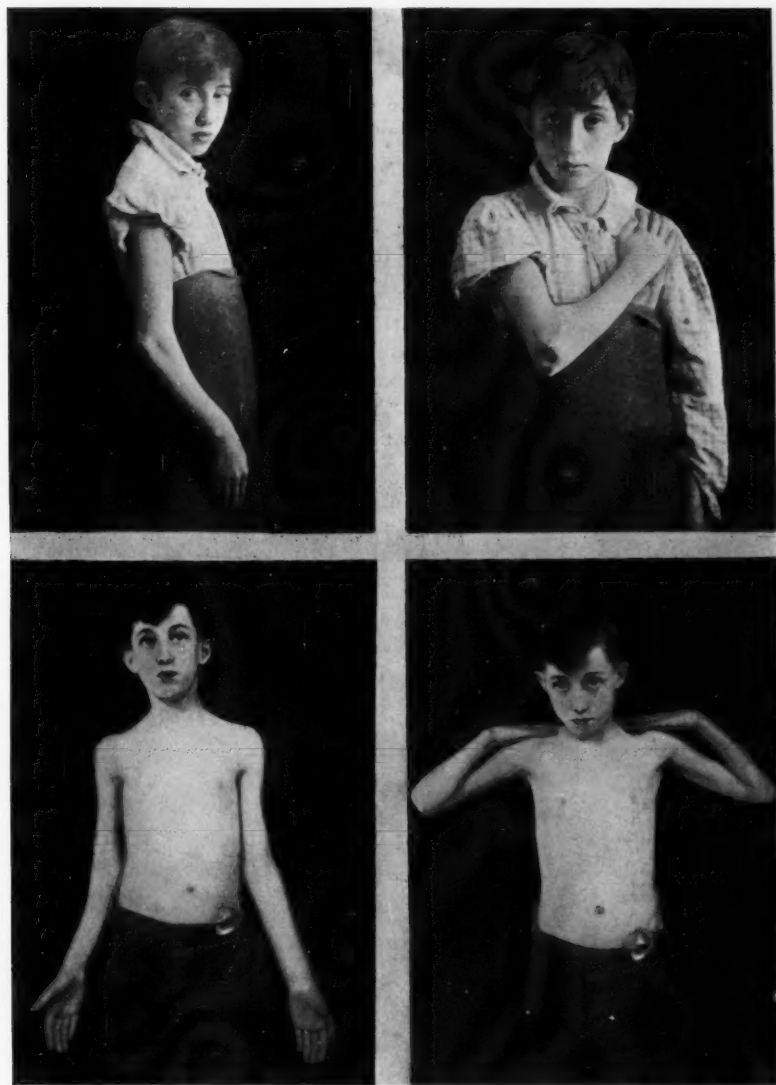


FIG. 20.—Case IV. Upper photographs show limits of extension and flexion before operation. Lower photographs were made five months after operation, showing results of arthroplasty.



FIG. 21.—Case V. Skiagraph before operation, showing bony ankylosis.



FIG. 22.—Case V. Skiagraph six weeks after arthroplasty.

ARTHROPLASTY OF THE ELBOW

orthopaedic department for disability from limited flexion and extension (65 to 150 degrees) (Fig. 20).

Operation (November 26, 1913).—Arthroplasty by the usual technic. After trimming the end of the humerus to proper shape with the bow-saw, it was found the ulna tended to stay in posterior luxation; so the olecranon was removed, preserving the periosteal attachments of the triceps. The radial head and the greater sigmoid cavity of the ulna were not disturbed. A flap from the triceps was inverted as usual, and the epicondyle was re-attached by chromic-gut sutures. No drain. Dressed on internal right-angled splint.

November 29: Discharged from ward. Skiagraph shows subluxation backward of radius and ulna.

December 1: Out-patient. First dressing; some sloughing of edges of skin flap turned back to expose triceps. Wound is clean. Elbow dressed in hyperflexion.

December 15: Skin granulating well. Free motion from hyperflexion to right angle. Arm in sling.

December 22: Motion 45 to 120 degrees. Out of sling.

January 5, 1914: Incision healed. Motion 40 to 145 degrees.

January 12: Motion 40 to 150 degrees.

January 19: Motion 40 to 160 degrees.

March 9: Motion 10 to 160 degrees.

April 27: Five months after operation (Fig. 20). Motion 10 to 180 degrees. In full extension radius and ulna luxate backward. There is free lateral motion in elbow, though external condyle is firmly attached to the humerus. Very slight power of extension in elbow, good power in flexion.

June 29: Seven months after operation. Can chop wood holding axe in both hands, indicating a considerable improvement in the stability of the elbow.

CASE V.—*Bony ankylosis of elbow from septic arthritis.* Sarah M., aged twenty-seven years. Dr. Ashhurst's service at Episcopal Hospital (orthopaedic). In December, 1913, this patient suffered from a "heavy cold" with cough; she was in the habit of carrying her eighteen months' old baby on her left arm, which gradually became stiff and painful. In less than a week matter formed, and an abscess on the inner side of the joint was lanced by her family physician. She was admitted to Dr. Frazier's service in the Episcopal Hospital on January 8, 1914, and on January 20 Dr. Frazier opened the sinuses more freely and put in drainage tubes. Cultures of pus at this time gave a pure growth of streptococcus pyogenes. The elbow became stiff. She went home in the end of February, and the sinuses were all healed early in March, 1914. Since then there has been no pain or tenderness.

ARTHROPLASTY OF THE ELBOW

Examination in May, 1914, showed ulno-humeral ankylosis at an angle of 110 degrees. She could not get her hand to her mouth, nor even to the top of her head. Rotation in the forearm was about half normal, supination being lost. Fig. 21 is from a skiagraph before operation.

Operation (May 30, 1914).—Arthroplasty by the usual technic. All told, sections about 0.5 cm. in thickness were removed from the humerus by the mounted Gigli saw. A flap from the triceps was interposed, and the external condyle re-attached by a screw. No drain. Dressed on internal right-angled splint.

June 6: First dressing. Wound healed. Can put hand to face with ease.

June 8: Went home.

June 15: Out-patient. Motion 70 to 100 degrees. Massage ordered.

July 13: Motion 85 to 110 degrees causes pain at limits named.

August 31: Free and easy motion 90 to 120 degrees. Rotation normal. Refuses to have forceful motion under an anæsthetic. Fig. 22 is from a skiagraph made six weeks after operation.

SUMMARY OF RESULTS IN FIVE CASES OF ARTHROPLASTY OF ELBOW

Case	Before Operation			After Operation		
	Flexion	Extension	Deformity	Flexion	Extension	Deformity
I	40°	145°	Varus	35°	150°	None
II	40°	110°	Varus	40°	170°	None
III	110°	110°	Ankylosis	45°	150°	None
IV	65°	150°	Posterior dislocation	10°	180°	Posterior dislocation (only in extension)
V	110°	110°	Ankylosis	90°	120°	None

EMPHYEMA *

EXPLORATION OF THE THORAX WITH PRIMARY MOBILIZATION OF THE LUNG

BY HOWARD LILIENTHAL, M.D.
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FOR many years the approved operative treatment of pyothorax has been by drainage more or less perfect through an incision with the removal of short sections of one or two ribs.

Seldom has there been any effort to determine or treat the primary cause of the condition, empyema being too often regarded as itself a disease instead of as a phenomenon resulting from some other process. Doubtless we have frequently missed the superficial lung abscess, the remote septic focus or even the adjacent subdiaphragmatic infection.

Also, the mechanical problems arising from adhesions and sacculations have not often been investigated on the table at the primary operation. Because of tradition we have been satisfied with unsurgical incision without proper inspection and usually with the merest pretence of digital exploration. A mortality of 25 per cent. or more with about 23 per cent. of secondary operations (Wilensky, *Surg., Gyn. and Obst.*, vol. 20, No. 5) and a large proportion of the cases ending in permanent fistulae or, despite the hazard of repeated operations, in unsightly or even disabling deformities—these surely are not pleasant things to contemplate in the days of modern progress and enlightenment.

And the patients often enough remain in the hospital for weeks and months, long outstaying their welcome as "interesting cases."

Lloyd (*ANN. OF SURG.*, vol. xlv) has suggested the systematic exploration of the chest during the primary operation for empyema to seek the cause, the complications and the remedy of the disease. He made a long stride in the right direction when he advocated freeing the lung from its adhesions (Delorme, Fowler, Ransohoff), but he accomplished this with the help of multiple rib resection, a procedure of magnitude and danger. There is also much hemorrhage during the separation of the lung from the chest wall. His results, however (20 per cent. mortality), were better than those of his predecessors.

A little more than a year ago I began to study the problem of non-tuberculous suppuration within the pleura and made a preliminary announcement (*N. Y. Med. Jour.*, January 30, 1915). The present paper is to report progress after a year's work.

* Read before the American Surgical Association, June 11, 1915.

HOWARD LILIENTHAL

The first step was to apply a rational technic which should make possible a more accurate knowledge of the pathological anatomy of empyema in the living.

In my other intrathoracic work I had noted the wonderful exposure afforded by wide rib retraction through a long intercostal incision, and I adopted this operative principle as a primary evolutionary move with the provision, however, that it might be necessary in some cases to make it actually the second step of a two-stage operation, applying the good surgical motto of "safety first."

In treating pyothorax a cure is to be striven for in the shortest time and with the fewest operations.

There are two important objects: (1) exploration of the pleural cavity and (2) mobilization of the lung.

In critical cases a small incision between the ribs for relief only should precede the radical operation by one or by several days.

Exploration.—A transpleural incision is made in the seventh or eighth interspace close to the upper border of the rib from the angle almost or quite to the cartilage. Part of the latissimus dorsi and serratus magnus muscles must be divided and in the adult such an incision may be eight or nine inches long. Preferably local anæsthesia is employed up to this point, to be followed now by nitrous oxide and oxygen. Ether had better be avoided, owing to the danger of irritating an already diseased lung.

The mechanical rib-spreading retractor is then placed in position. This instrument will widen the intercostal space to four inches or more, permitting a thorough inspection of most of the interior of the thorax. The intrathoracic procedure will depend upon what is disclosed at this exploration. A bulging and rigid diaphragm, for instance, may suggest a complicating subphrenic abscess and puncture here may lead to an incision and evacuation.

Many other conditions might be enumerated, but for the sake of simplicity let us assume that we are dealing with a recent metapneumonic empyema or perhaps with one in which the pulmonary disease has not yet entirely abated. If we suspect an active pneumonia and if a tense pyothorax urgently demands intervention a tiny intercostal incision will temporarily relieve the patient and may even permanently cure the disease. The mere fact, however, that pus has been found on aspiration does not of itself mean that immediate radical operation is called for. Sometimes a delay of a few days with no operation will give time for a more complete resolution of the pneumonia.

Exploring in the early cases we may exceptionally find the lung truly



FIG. 1.—Rib retractor in place. Knife incising pleural exudate.

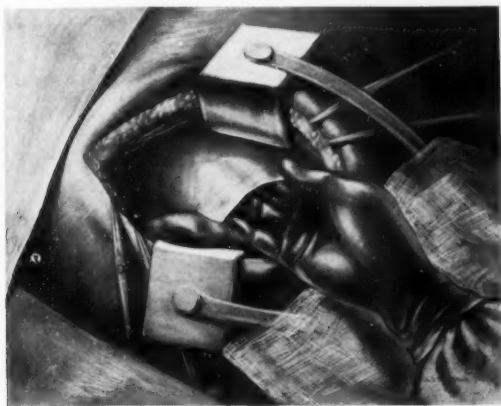


FIG. 2.—Stripping exudate from pleura. Lung bulging below.



FIG. 3.—Lateral incisions made with scissors. Lung bulging out. Part of this exudative membrane may be cut away.

EMPHYEMA

free and its fissures visible. If so we need but remove the loose flakes of fibrin and close the chest in the manner to be described farther on.

Perhaps the lung is free everywhere except over the surface of the diaphragm where the lower lobe adheres. As Lloyd has noted, it may be quite difficult to mark the place where the lung and diaphragm meet. Gently peeling this adhesion away we may come upon a sacculation of pus which doubtless would have made trouble had it remained undiscovered. Or perhaps a tender adhesion toward the mediastinum covers a pocket of pus, often different in appearance and consistency from that in the general cavity.

The lobes should now be carefully separated to look for purulent collections.

Sacculations of intrapleural pus are apt to become rapidly surrounded by rigid and dense adhesions and these cavities if not evacuated early will collapse slowly or not at all. This tendency of pleural exudates to become thick and of cartilaginous rigidity forms the most cogent argument for timely lung mobilization. A description of the method follows.

Mobilization of the Lung.—As early as ten days—perhaps sooner—after the probable beginning of the empyema it may be found on inspecting the opened chest that the pleura is covered by a grayish or greenish uniform membranous exudate which obliterates every landmark. The chest cavity may not show even a bulging to indicate the location of the lung as it lies compressed against the mediastinum, the spinal column or the chest wall. These are the cases which, treated by the old methods, would be followed by delayed healing, by fistulæ, or by contractures of the thorax.

Before proceeding to the next step all bleeding points must be secured so that the wound is dry. After wiping away the pus and loose fibrin we may incise the fibrinous coating of the pleura with the scalpel under visual guidance from near the apex to the base (Fig. 1). There should be no bleeding from this incision unless the lung itself has been superficially wounded—not a dangerous accident. Now find the plane of cleavage and carefully separate the plastic material from the viscus with the fingers, the dorsal surfaces next to the lung (see Fig. 2). When this has been accomplished as far as possible it will be necessary to make lateral deep cuts into the loosened membrane with the scissors so as to free the lung more completely (Fig. 3). The tissue is not vascular and will bleed little if any and the lung will bulge out through the opening made in its retaining membrane. Such flaps of exudate as can be easily reached may be removed.

At this point I call attention to the dangerous hemorrhage which may follow the tearing away of tough adhesions *between the lung and the chest wall*. It is therefore urged that as a rule these adhesions be not disturbed except in early cases when they are very soft. The lung mobilization will be just as well accomplished if the plastic visceral covering is peeled away; and the loose flaps of this membrane on complete expansion of the lung will later become adherent to the costal pleura. During this part of the operation sacculations, if present, will be discovered and may be evacuated.

In the left chest the pericardium must be guarded from trauma. Even during the retraction of the ribs tearing of this structure when covered by adherent thickened and inelastic membrane is a conceivable accident, though it has not occurred in any of my cases. In the low incision the diaphragm, too, may be torn by the retractor or it may be wounded in too violent efforts at freeing the lung. The rent should be repaired and a packing of gauze laid over the place.

The intrathoracic work completed, the retractor is removed, and it will be found that the ribs remain apart in the adult two inches or more. I have found it advisable not to draw them together by pericostal or percostal sutures, but merely to approximate with catgut stitches the latissimus and serratus. This will draw the ribs together to a certain degree, but not enough to interfere with drainage. The skin wound is closed with silk except at the point, usually in the midaxillary line, where drainage is to be provided. A short tube, or two or three, may be used to promote drainage but often the opening itself will suffice without tubes. The ribs will come together in from five to ten days.

After-treatment.—Immediately after this operation some shock may be expected but in my cases it has invariably yielded to a small dose of morphine or codeine.

During convalescence the patient seems to experience greater comfort on moving about than there is when ribs have been resected. Open air treatment is of the greatest value.

It is necessary to expand the lungs by blowing exercises or by straining with the glottis closed so as to prevent the formation of sacculating adhesions, and these exercises should be begun as soon as possible after the operation. Should a sudden rise of temperature indicate retention the thorax may be explored with the finger or with a sound and evacuation secured. I have found the suction apparatus most useful in treating these patients. It should be attached to a tube draining the thorax and should be used at least half an hour at a time, twice or thrice daily. There are various forms of apparatus. I have used an electric vacuum cleaner, a water air-pump and a combined

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electric pump and vacuum tank. The pump and vacuum tank arranged for graduated suction has given the greatest satisfaction. In Mt. Sinai Hospital the apparatus is installed in one of the examining rooms and the patients are taken there for suction treatment. In only one of my cases was a counterincision necessary and this might have been avoided by a more timely post-operative exploration before the adhesion had become too firm.

Infection of the wound may naturally be expected in these cases. This has not led to serious complications since drainage is so free.

The procedure as here described is the typical method of operating, but it must not be assumed that no departure from it is to be permitted. On the contrary, as in all branches of surgery, each case must be treated according to its conditions. It may after all be necessary in special cases to separate tough adhesions between lung and chest wall or it may be considered wise in a given case to resect a rib. What I have described is the procedure in an ordinary case. My whole contention is for rational modern surgery in the treatment of thoracic empyema.

After a trial of more than one year, although the number of cases is not large, I feel that I can conscientiously advocate this operation. Those who have seen it and who have followed the cases have said that they were impressed by its elements of safety combined with thoroughness.

I can report on but 23 cases operated upon by this method between April 27, 1914 and May 30, 1915.

All of these excepting one were nontuberculous empyemata.

Twenty-one were operated upon by me and two by Dr. Martin W. Ware.

Of these 23 patients, 4 are still in the hospital but may be considered convalescent. Four died, 17 per cent.

Of the patients discharged from the hospital all are well excepting one—the tuberculous case which is unhealed.

There were 20 one-stage operations and 3 two-stage operations. None of the two-stage cases died.

There have been no thoracoplasties.

The oldest patient was fifty-three years old and the youngest sixteen months, the average age being about sixteen years.

Bacteriology recorded in 16 cases was as follows:

Staphylococcus aureus	3
Pneumococcus	8
Streptococcus hæmolyticus	4
Tuberculosis	1

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DEATHS.

J. P., a man of thirty-nine (Bellevue), left empyema, died of acute pneumonia of the entire right lower lobe, which came on seven days after the operation and killed in twenty-four hours.

B. T., a girl of three and a half years (Mt. Sinai), left empyema, streptococcus hæmolyticus, died six weeks after the operation of pneumonia of the left apex.

J. S., a man thirty-five years of age (Mt. Sinai), had gangrenous left-sided pleurisy and streptococcus pyopneumothorax and was in an almost moribund condition. Died a few hours after operation.

N. T., a boy aged two years (Mt. Sinai), right pneumococcus empyema. Died six weeks after operation of a slow sepsis. Unfortunately no autopsy.

It is, of course, impossible to draw any except the roughest conclusions from such a small number of cases. At the same time it is hoped that other surgeons may become interested so that the method may receive a wider trial.

When a sufficiently large number of cases are available another report will be made by the writer with the collaboration of his associates of the First Surgical Service of Mt. Sinai Hospital, Dr. Joseph Wiener and Dr. Martin W. Ware.

BANTI'S SYMPTOM COMPLEX WITH RELATION TO SPLENECTOMY*

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SPLENECTOMY in splenic anæmia, or Banti's symptom complex, should be recommended under the following conditions:

First, in adults, when the diagnosis is agreed upon by a good physician and a competent surgeon.

Second, when the condition of the patient is sufficiently good to withstand what may be a very serious operation; or when a poor condition can be sufficiently improved by one or more previous transfusions.

Third, in children, only after a very thorough trial of all possible medical methods of treatment, including fresh air, sunshine, careful nursing, liberal and appropriate diet, as well as the judicious exhibition of drugs. In a large majority of cases, a high white count, or a considerable recurring or continuous fever are contra-indications. In children also the agreement of physician and surgeon is an essential pre-operative requirement.

Splenic anæmia is distinctly a borderline condition. In adults, most physicians of wide experience agree that it is only cured by operation, and that it is by this means permanently cured. In adults, therefore, it is not necessary to wait (except for transfusion) once the diagnosis is established. Banti's symptom complex is in most cases a slowly progressing condition, often with periods of considerable temporary improvement: in a minority of instances the disease progresses rapidly; in practically all cases it terminates fatally. Unfortunately, neither the public, nor indeed the profession taken as a whole, is convinced of the importance of the early operative attack. It is certain (as Cushing has pointed out concerning disorders of the pituitary body) that splenic anæmia is more common than at present seems to be the case; two facts contribute to explain the failure to diagnose splenic anæmia more frequently—first, the fact that the spleen must be increased to about three times its normal bulk before it can be palpated; second, the lack of a careful and exhaustive physical examination in every case of anæmia, in particular directed to the condition of the abdominal viscera. The vast majority of these cases come at first under the care,

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not of the specialist or surgeon, but of the general practitioner—and an early diagnosis is almost as important as it is in the case of cancer.

On the part of the layman, it is obvious that the community is not yet educated to the idea of splenectomy for anæmia; the operation seems even more formidable than it is; the condition often not sufficiently alarming; and the symptoms not as striking and convincing as in the more acute surgical conditions—for example, appendicitis; furthermore, the mortality is distinctly higher, and probably, in spite of increasing knowledge, will remain higher. It is difficult to obtain reports of cases which die shortly after the operation. As a result of such considerations as these, the patient is usually in a condition in which a word of doubt concerning operation, or even a lack of vigor in suggesting it, causes refusal to accept the surgeon's advice. This is a very important matter and one which is incumbent upon the physician to modify; the physician has educated the patient to recognize the necessity for operation in appendicitis and gall-stones—it is now time to do similar service in all appropriate borderline cases; and for the surgeon, it is most important that too great enthusiasm does not render him less appreciative of careful indications and operative risks: we have only to recall the history of splenectomy for leukæmia to realize that one large group of the splenomegalies at first attacked vigorously, do not belong to the surgeon at all (63 deaths following 66 operations, Carstens). It is therefore essential that the patient be early prepared for the fact that medical treatment will be almost certainly unavailing, and that surgical interference is not only necessary, but that it should not be too long postponed. The writer has seen no less than four cases in the past year, all appropriate for operation, in which the patient refused. It is almost certain that these cases would have accepted operation had it been brought early to their attention, and sufficiently insisted upon by the first doctors in attendance.

There is no doubt that transfusion is a valuable aid in temporarily improving the patient's pre-operative general condition: the writer is convinced that at least twenty-four to forty-eight hours should elapse between the transfusion and the operation; the change produced by the father's blood in the child whose case history is appended, was little less than marvellous. Furthermore, it would seem that not more than ten or twelve ounces of blood is, as a rule, necessary, since the effect produced in the recipient is probably due rather to the quality than to the quantity of the blood. Although the writer has not done it, nor seen it done, there is no obvious reason why a transfusion should not be repeated in a week or ten days, if after the first the patient's condition

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still seems not all that is desired to stand the operation. In the second case history appended, it might seem at first that the transfusion had some effect in precipitating the fatal intestinal hemorrhage; this was probably not true, and the occurrence of the hemorrhage at that time was purely coincidental.

In the case of children with anæmia, in association with enlarged spleen and liver, and with leucocytosis, most pediatricians are very conservative in relation to surgical measures, and probably with good reason. Not long ago a well-known professor of children's diseases remarked that he believed he had saved the lives of many such babies by not referring them to the surgeon: in his opinion almost all such cases improved and got well, the spleen returning to its normal size (or at all events to a size at which it could not be palpated) under careful nursing and feeding in the country. That not all cases react in this way is proved by Case I appended. The cases that improve under treatment, and some that do not, are regarded by this physician not as "splenic anæmia in infancy," but as disturbances of nutrition, and the prognosis is good or bad according to the blood picture, and the presence of other pathological conditions (rickets, syphilis, tuberculosis, etc.). For these reasons, the surgeon approaches children presenting conditions similar to splenic anæmia with very great caution.

The cause of Banti's complex is a most interesting and difficult problem. It is to be hoped that Yates's work in this line will soon be finished and reported in full; a preliminary note has already appeared.

Mallory in his pathology says: "Banti's disease seems to be a symptom-complex resulting from partial occlusion of the splenic or portal vein, and marked obstruction to outflow of blood from the spleen; swelling and much increase of connective tissue of the organ result."

Mallory evidently believes that Warthin has proved his contention beyond question, viz.: "Until it is definitely shown that splenic anæmia can exist without any evidence of obstruction in portal or splenic vein, Banti's disease and splenic anæmia must be regarded as coördinated symptom-complexes, and not individual disease-entities," and "the whole pathological picture points to an infective thrombophlebitis of portal or splenic vein as the essential feature of all these cases, no matter under what head reported (splenic or portal thrombosis, splenic anæmia or Banti's disease)."

It is certainly impossible to read Warthin's exhaustive article carefully (*International Clinics*, vol. iv, 20th Series, 1910, page 189) without sharing the conviction that his conclusions are correct. Assuming this to be the case, anything which may cause a splenic or portal throm-

bosis may be the cause of splenic anæmia; this simplifies and explains many apparently inconsistent facts: we must believe that infection, whether or not we can trace it, plays the leading rôle in all cases of phlebitis, no matter where located; and that infection of all sorts may cause inflammation and thrombosis in veins; hence it becomes apparent why splenomegaly follows tuberculosis, syphilis, malaria, and pneumonia as well, and why it may also follow infection of the gall-bladder, as has recently been suggested in the Mayo Clinic. Since "hypertrophy of the spleen," no matter of what origin, appears to cause in the majority of cases a diminution in red blood-cells and hæmoglobin, associated in many instances with a leucopænia (Warthin), the sequence is as follows: infection causing splenic vein thrombosis; this causing hypertrophy of spleen; this causing anæmia and leucopænia; this completing the symptom-complex. Splenectomy does not remove the cause, but removes an effect of the cause which had itself become a menace to life.

The following three cases are reported in detail. The first was entirely well when last heard from. It was the most successful surgical operation which has fallen to the writer's lot to perform. The second case was obviously, from the patient's report, one of great complexity, yet had an early splenectomy been accepted and performed, together with salvarsan and mercury, it would almost certainly have prolonged life considerably and probably have produced what might be called a symptomatic cure of the patient. The third case is cited as one in which indication for immediate splenectomy was positive, medical treatment having already been carefully carried out. Unfortunately, the patient refused operation. She is, so far as is known, alive at present, but slowly losing ground.

CASE I.—Rose Mulliano, two and a half years old. (September 27, 1913.) Lymphoblastoma of spleen.

Family History.—Father and mother living and well. No history of alcohol, tuberculosis or cancer. One brother and one sister living and well. Each had pertussis six months ago.

Personal History.—Full term normal delivery; weight at birth unknown. Breast-fed 5 months. Baby was well up to age of 4 months when she began to cry frequently, especially on micturition or defecation. Micturition at times irregular, always painful. Bowels regulated with castor oil. At age of 9 months baby was taken to Lowell General Hospital where she remained seven weeks without improvement. At that time the mother had noticed a mass in the abdomen and many furuncles. Baby kept at home until February, 1913, when she was taken to the Lowell City Hospital

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because of "very poor condition;" jaundice, anasarca, ascites, large mass in abdomen, and frequent febrile attacks. Occasional attacks of marked tremor and convulsive movements limited to the hands. First tooth appeared at age of 6 months; soon followed by two more, and then no more until in Lowell City Hospital, where, between February and July, 1913, nine teeth were cut. Baby began to improve steadily after entering Lowell City Hospital; color became better, œdema disappeared, ascites went down, and mother thinks that tumor became smaller. Micturition became painless and defecation regular. On discharge from the hospital, baby began to creep and to say simple words.

Present Illness.—Since July, 1913, following discharge from hospital, baby has again grown weak and pale. Micturition irregular and painful; defecation very painful; appetite poor; stools at times watery, green to black in color. Baby sleeps poorly.

Physical Examination.—Fairly developed and nourished. Pale. No dyspnoea or cyanosis. Not acutely sick. No evidence of pain. Fontanelles closed. Frontal eminences somewhat prominent. Radial epiphyses large; slight rosary. No Harrison's groove. Spinal column in normal alignment. Slight outward bowing of tibiae. Ears, eyes and nose negative. Mouth: high narrow palatal arch. Teeth: 6/6, in good condition. Throat and neck negative. Lymph-nodes: no general enlargement. Few small glands .5 cm. in diameter in cervical triangles and in groins. Heart and lungs negative. Abdomen: slightly protuberant; liver dulness from fourth interspace to $2\frac{1}{2}$ cm. below costal margin in right midclavicular line. In left upper quadrant is a palpable, firm mass with a definite sharp edge, freely movable, extending from a short distance above costal border well around towards spine, it fills most of left upper quadrant, and near the umbilicus it extends somewhat into right lower quadrant. Right half of abdomen is soft and tympanitic. Extremities and skin negative.

Blood examination: Hæmoglobin 45 per cent.; white blood-cells, 6,600; red blood-cells, 2,496,000.

Urine shows many pus cells. Child is comfortable. Seen in consultation by all medical services, who agree that tumor is spleen. Stool negative. X-ray plates show tumor is spleen.

October 3: Wassermann negative. October 7: Patient cries when passing urine. Movements occasionally foul, well-formed, brown, with small amount of mucus. October 19: Hæmoglobin 40 per cent. Blood examination: White blood-cells, 6,000. Smear: polymorphonuclears, 31 per cent.; lymphocytes, 60 per cent.; mononuclears, 8 per cent.; eosinophiles, 1 per cent.; 4 normoblasts. *Patient transferred to first surgical service.* October 28: Transfusion was done under ether, causing improve-

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ment in condition and in color. October 29: Splenectomy; spleen was found to be free from adhesions; pedicle clamped and cut. Good ether recovery. Patient made uneventful convalescence and was *transferred to first medical service*. November 29: General condition excellent. Gaining weight and strength. Is fast learning to talk. December 5: Hæmoglobin, 70 per cent.; white blood-cells, 9,200; red blood-cells, 2,900,000. Smear: polymorphonuclears, 44 per cent.; lymphocytes, 29 per cent.; small mononuclears, 22 per cent.; transitional cells, 5 per cent. December 16: Hæmoglobin, 70 per cent.; white blood-cells, 6,500; red blood-cells, 3,800,000. December 19: Hæmoglobin, 70 per cent.; white blood-cells, 6,500; red blood-cells, 3,800,000. Smear shows polymorphonuclears 65 per cent., large lymphocytes 10 per cent., small lymphocytes 16 per cent., myelocytes 9 per cent. January 3, 1914: Smear: polymorphonuclears, 39 per cent.; lymphocytes, 59 per cent.; myelocytes, 2 per cent. February 2: General condition has been excellent. Discharged well to mother.

CASE II.—Warren Mulrey, aged forty-seven, brass worker, married. (October 23, 1913.) Splenomegaly.

Family History.—Negative. No cancer.

Personal History.—Does not remember any diseases of childhood. Twenty years ago "rheumatism;" joints were swollen and tender; had some fever and since then has had mild pains in all joints. Seventeen years ago syphilis. Formerly used alcohol to excess, but for past three years has used very little, averaging 3 glasses of beer a day.

Present Illness.—Felt perfectly well up to three years ago when one day at work he suddenly felt dizzy and weak; had fulness in the epigastrium and within a few minutes vomited much black material. Went to Relief Station and from there was sent home, where he stayed in bed four days. He was advised by his physician to omit all alcohol. Since then he has had two similar attacks but has not vomited. He has noticed black stools following each attack. On October 19 he felt suddenly weak and dizzy; had a "cold sweat;" passed some black stools: the stools contained fresh blood. He had no vomiting at that time and felt fairly well up to October 22, when he had another "giddy attack" and vomited about one pint of fresh blood. He thinks he has lost 20 pounds in the last three years. Appetite fair; no history of "indigestion;" has found it increasingly difficult during past three years to do his work.

Physical Examination.—Fairly developed and nourished; pale; no dyspnoea or cyanosis. Eyes, ears, nose, throat negative. No general glandular enlargement. Heart and lungs negative. Abdomen: soft, level and tympanitic. Liver 2 cm. below costal

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margin. In the left upper quadrant is a smooth, oval tumor moving with inspiration to level of umbilicus; no tenderness or spasm. Extremities negative.

Hæmoglobin, 65 per cent.; white blood-cells, 8,000; red blood-cells, 3,700,000. Urine negative. Stools black; no fresh blood, but benzidine test positive; Wassermann reaction + + +.

October 27: Patient put on potassium iodide grs. xv t.i.d. and proto-iodide of mercury gr. $\frac{1}{6}$ t.i.d. Patient has had no hemorrhage. October 31: Patient given neosalvarsan .45 gm. intravenously. November 3: Seen in consultation by Dr. Libby, who suggests gumma of spleen. Physician considers possibility of new growth. November 6: Patient complains of occasional dull pain in right upper quadrant. Eats well. Tumor unchanged. November 7: Neosalvarsan .9 gm. followed by slight reaction. November 11: Oxycyanate of mercury intramuscularly. November 14: Neosalvarsan .9 gm. November 17: Seen by First Surgical Service with question of splenectomy, which was recommended unless immediate improvement obtained. November 21: Neosalvarsan .6 gm. Blood examination: Color index, 13/11; red blood-cells, 2,676,000; white blood-cells, 5,200. A loss of 1,000,000 reds since entrance. Wassermann still + + +. General condition unchanged. Rectal examination negative. December 3: Seen by Dr. Joslin who advises continuation of present treatment with addition of iron (Blaud pills). Blood examination: red blood-cells, 1,808,000; white blood-cells, 4,200; hæmoglobin, 55 per cent. December 10: Blood examination: red blood-cells, 1,767,000; white blood-cells, 4,000; hæmoglobin, 55 per cent. December 15: Blood examination: red blood-cells, 2,400,000; white blood-cells, 4,600; hæmoglobin, 65 per cent. December 23: Patient's condition unchanged. General condition is good. Spleen is not decreased in size. Has had no hemorrhage. Desires to go home.

Patient returned to hospital in February to have splenectomy performed, stating that since his discharge he has had increasing weakness and pallor, but gives no definite history of a hemorrhage. Was kept in bed for several days in preparation for operation. His son gave blood for transfusion, but patient died in three days following transfusion from severe hemorrhage, vomiting much fresh blood and passing large amounts of blood by rectum.

Anatomical Diagnosis.—Esophageal varices and hemorrhage; anæmia; congestion of lungs; sclerosis of liver; chronic nephritis; chronic passive congestion of spleen; obliterative fibrous pleuritis; arteriosclerosis; chronic fibrous localized peritonitis; hydrothorax; ascites; chronic fibrous perihepatitis; chronic fibrous perisplenitis; chronic fibrous pleuritis; chronic periostitis

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of tibia; sclerosis of testis; scar at base of penis; scars on shins; Mural thrombus of portal vein; osteoporosis of calvarium.

CASE III.—Female, aged thirty-four, housework, married. (November 27, 1913.) Splenic anæmia.

Family History.—Negative.

Personal History.—Negative. No alcohol.

Present Illness.—Patient states that about two months ago she began to have severe headache, trouble with her eyes, frequent urination and felt badly all over. Noticed that her feet and ankles began to swell. The swelling spread up to her knees. Finally her abdomen became distended. Has had some nausea, but no vomiting. Has steady abdominal pain in left upper quadrant. For past two months bowels have moved three to four times a day; movements are watery in character. Has had attack of vertigo. No other symptoms obtainable.

Admission diagnosis: chronic diffuse nephritis.

Physical Examination.—Well developed and fairly well nourished. Eyes, ears, nose and throat negative. Heart: 1 x 14 cm.; action regular, systolic murmur over entire præcordia, loudest at second left interspace, transmitted to neck; faint diastolic murmur heard in third left interspace. Pulses regular, equal, fair volume and tension. Lungs: dulness at both bases and at left apex and front. Many fine and medium moist râles at bases. Few fine râles over apices in back. Abdomen: very prominent. Liver and spleen easily palpable, markedly enlarged, especially the spleen. Extremities: marked œdema of feet and legs.

Urine examination: negative.

Wassermann reaction negative.

Systolic blood-pressure 138 mm.

Blood examination: Hæmoglobin, 35 per cent.; white blood-cells, 4,800; red blood-cells, 3,200,000. Smear shows marked achromia: moderate variation in size; no normoblasts seen. Differential count: polymorphonuclears, 62 per cent.; mononuclears, 38 per cent.

Treatment.—Restrict fluids; chronic nephritis diet; salts oz. 2 every A.M.; tincture citrochloride of iron ℥ 10 t.i.d. p.c.; strychnine gr. 1/100 t.i.d. a.c.

December 5: General condition improving. Œdema disappearing. Hæmoglobin, 35 per cent. December 14: Blood examination: hæmoglobin, 45 per cent.; red blood-cells, 2,720,000. Smears as before. Differential: polymorphonuclears, 66 per cent.; mononuclears, 32 per cent.; eosinophiles, 2 per cent.

Treatment: Fowler's solution ℥ 5 and increase ℥ 1 daily. December 24: Blood examination: hæmoglobin, 45 per cent.; red blood-cells, 2,500,000. Smears show 1 questionable normoblast.

BANTI'S SYMPTOM COMPLEX SPLENECTOMY

Polymorphonuclears, 64 per cent.; mononuclears, 35 per cent.; eosinophiles, 1 per cent. Splenectomy recommended and refused.

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CHRONIC INTESTINAL STASIS AS PRODUCED BY OBSTRUCTION AT THE ILEOCÆCAL REGION AND AT THE HEPATIC FLEXURE *

WITH REPORT OF NINETEEN CASES

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CHRONIC intestinal stasis is a condition of chronic obstruction with stagnation of the intestinal contents resulting in an excessive production of toxic material, the absorption of which leads to a chronic poisoning of the entire organism.

Until comparatively recent years this condition was known as "chronic intestinal auto-intoxication," or "chronic intestinal toxæmia," the obstructive element being entirely overlooked. It was reserved to Sir W. Arbuthnot Lane to point out that practically all cases of chronic intestinal poisoning are due to purely mechanical causes and that such mechanical causes may be removed or corrected by appropriate surgical measures.

It has been shown by Lane, Jackson, Bainbridge, and others, that this mechanical obstruction is produced by various adventitious bands and membranes, concerning the etiology of which a number of theories have been advanced.

The most commonly accepted of these theories are the evolutionary theory of Lane, the congenital theory of Reid, Mayo, and others, and the inflammatory theory of Pilcher. Whatever may be their origin there is no doubt that these adventitious bands and membranes are of very frequent occurrence and are the cause of a great deal of suffering and ill health, if not of even much more serious consequences.

A very large percentage of all cases of chronic intestinal stasis are due to obstructions of the intestine at two points, namely, at or near the ileocæcal valve and at or near the hepatic flexure of the colon.

In the ileocæcal region the obstruction may be due to a Lane's kink, to an adherent appendix, to an unduly developed ligament of Treves with fixation of the appendix, to gross adhesions involving small intestine, cæcum, and omentum, and perhaps to incompetency of the ileocæcal valve. Obstruction in the ascending colon or at the hepatic

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flexure may be due to a Jackson's membrane or to angulation of the flexure by a membrane binding together the ascending and transverse colons. A freely movable and prolapsed cæcum will tend to increase any coexisting obstruction and may in itself be the cause of stasis.

Not infrequently a combination of these conditions is present in any given case.

Membranes and bands attached to the splenic flexure and sigmoid have been described by Lane, Bainbridge, and others. Such conditions must be uncommon, at least in the male. In a series of nineteen cases coming to operation during the past year and in another series of nine cases previously observed (*ANNALS OF SURGERY*, January, 1914) in not one were obstructive symptoms present in either of these localities and in none was there a membrane or band found at the splenic flexure or pelvic colon (sigmoid) at operation.

A Lane's kink is an angulation or kinking of the terminal ileum by a band of peritoneum which extends from the parietal peritoneum of the right iliac fossa, usually that overlying the iliac vessels, to the wall of the intestine at a point within five or six inches of the ileocæcal valve.

Jackson's membrane is a thin, transparent, veil-like membrane which arises from the parietal peritoneum, to the outer side of the ascending colon, passes over the colon and hepatic flexure, and loses itself in the wall of the gut near its mesenteric attachment. Numerous fine blood-vessels course through this membrane, in direction from above downward and inward, which vessels bleed rather freely upon being cut. In this membrane there are a number of thickened bands of fibrous tissue which follow the course of the blood-vessels. Such bands may improperly fix and angulate the hepatic flexure, thus producing obstruction. In other cases one or more such bands will be seen passing across the ascending colon directly compressing it and causing obstruction. In still other cases the membrane will bind together the ascending and transverse colons, thus producing a kinking and obstruction at the hepatic flexure. The extent of this membrane is variable.

Angulation at the hepatic flexure may also be caused by a thick membranous layer of adhesions which binds together the last few inches of the ascending colon and the first few inches of the transverse colon. This membrane does not arise from the parietal peritoneum as is the case with Jackson's membrane, but is limited to the colon and seems to be a separate entity.

An appendix adherent to the under surface of the ileal mesentery,

whether its tip be attached to the wall of the gut or not, may cause obstruction by shortening the mesentery along the line of its attachment, thus producing a condition similar to Lane's kink. In some cases the attached appendix seems to form a part of an ileopelvic band. In other cases numerous small filaments extend from the tip of the appendix to the wall of the ileum.

Multiple adhesions following acute inflammation or operation produce various kinkings, angulations, and deformities of the ileum or cæcum, bringing about obstruction of greater or less degree. Not infrequently omental adhesions are the sole cause of the obstruction, either by directly compressing the gut or by becoming attached to it and thus making a fixed point of support.

The symptoms of chronic intestinal stasis as produced by the causes above enumerated are:

First, attacks of abdominal pain, which are usually referred to the epigastrium or right iliac region and which may or may not be accompanied or followed by vomiting. Such attacks are not associated with the taking of food.

Second, local tenderness which is practically confined to two areas, that of the right iliac region and the region of the hepatic flexure. The point of maximum tenderness in the right iliac region is usually somewhat below and internal to the point of greatest tenderness in appendicitis. In several cases in which the appendix lay to the outer side of the cæcum, the point of maximum tenderness was well to the inner side of and below McBurney's point, indicating that the tenderness was produced by the band or kink and not by the appendix. In other cases in which the appendix had been removed at a previous operation, the tender area lay directly over the ileopelvic band, which was the cause of the symptoms for which the second operation was done.

Third, constipation which is a marked feature in a majority of the cases. Constipation often precedes the attacks of abdominal pain by a considerable period. Not infrequently constipation alternates with a mucous diarrhoea.

Fourth, a sensation of distention by gas, often limited to the right side of the abdomen. Not infrequently the distended cæcum and ascending colon can be plainly felt.

Fifth, symptoms of intestinal auto-intoxication. Such symptoms are a feeling of general ill-being, a lack of energy, headache, backache, and loss of appetite. The conditions are described by our patients as "feeling dopey all the time." There is usually a sallow, muddy complexion, with rings beneath the eyes. The skin may be blotchy or

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spotted and the breath very offensive. Not infrequently neurasthenic symptoms develop. There is quite commonly a very considerable loss in weight.

Sixth, in addition to the above symptoms the most important diagnostic sign is stagnation of bismuth at certain points in the intestinal canal as shown by radiographs after a bismuth meal.

The symptoms of intestinal stasis may be further divided into *obstructive* and *toxic*. In the former there may be very severe attacks of abdominal pain, often referred to the epigastrium, and frequent attacks of vomiting. In the latter the symptoms of intestinal auto-intoxication predominate. In some cases the toxic symptoms entirely overshadow the obstructive, but careful questioning will usually bring out a history of attacks of abdominal pain. In such cases there are practically always present the areas of local tenderness above referred to.

The treatment of chronic intestinal stasis may be either medicinal, mechanical, or operative. Very often a combination of these methods is employed.

In early and mild cases a careful regulation of the diet and the administration of Russian mineral oil (liquid petrolatum) may suffice. In more advanced cases these measures, combined with the application of a supporting belt or mechanical spring support may entirely relieve the symptoms. In the majority of cases, however, in which the symptoms are well marked operative procedures are necessary. Such operative procedures consist of a free abdominal incision, either through the fibres of the right rectus or by displacing this muscle to the outer or inner side. The ileocæcal region and that of the hepatic flexure are then carefully explored. An ileopelvic band, if present, is divided transversely and the margins of the denuded area thus produced are united by suture in a line at right angles to that in which the band was divided. Very often considerable undermining of the peritoneum is necessary to entirely correct the angulation of the ileum produced by the band, but it is remarkable what very marked kinking and obstruction may be entirely relieved by this procedure. Not infrequently the ileum is markedly dilated proximal to the point of attachment of the band, and its contents can be "milked" past this point only with some difficulty. When the band has been freely divided it can be demonstrated that the obstruction has been entirely relieved.

In those cases in which the band is attached by its extremities only, simple division of the band will relieve the obstruction. Rarely two

distinct bands are present, both of which have to be divided transversely and the denuded areas sutured longitudinally.

Very often the simple removal of an adherent appendix will correct the angulation and obstruction. In those cases in which there is an ileopelvic band together with an adherent appendix, the band will naturally have to be divided in addition to the removal of the appendix.

In cases in which obstruction is produced by a ligament of Treves attached to the mesentery of an adherent appendix, the removal of the appendix by releasing the ligament will relieve the obstruction.

In those very common cases of obstruction resulting from omental and intestinal adhesions, the treatment consists of a very careful separation of the adhesions with division of the omentum where necessary and a thorough covering in of all denuded surfaces thus produced. Any raw surfaces that may be left after this procedure and all suture lines are liberally smeared with sterilized vaseline. Omental grafts may be employed to cover extensive peritoneal defects.

Obstruction in the ascending colon or at the hepatic flexure by a Jackson's membrane is corrected by dividing this membrane at such points as it is seen to be the cause of the obstruction, paying especial attention to the fibrous bands. In some of these cases the defects in the membrane thus produced may be corrected by uniting the margins of the opening in the membrane at right angles to the line of division. In those cases in which the ascending and transverse colons are united by Jackson's membrane or by the somewhat limited membranous formation above described, the conditions must be fully corrected by complete division of this restricting membrane.

In other cases, in which the membrane envelops the ascending colon and hepatic flexure and even the transverse colon as if these structures were contained in a membranous bag, the membrane must be fully divided to such an extent as is necessary to completely correct any angulation or obstruction.

In all cases the margins of the divided membranes are well covered with vaseline to prevent subsequent adhesions.

In not a few cases of obstruction and stasis the cæcum is unduly movable and prolapsed. This is the condition described by Wilms as "cæcum mobile," which may be remedied by uniting the external longitudinal band of the cæcum to the lateral abdominal wall, by two or three interrupted sutures.

It may be noted that the more radical operative procedures of short circuiting or colectomy have not been mentioned in the above discussion. In not one of twenty cases of chronic intestinal stasis operated

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upon during the past year did such measures seem indicated. Eighteen of the twenty cases were markedly improved or entirely cured by the operative measures above outlined and were restored to active service in the Navy. In one case the patient was of the opinion that he had not been benefited by the operation. His general appearance, however, was decidedly improved and he was returned to duty. In another case very marked improvement followed the cutting of a Lane's band which was maintained for about three months. At the end of this period symptoms suggestive of ulcer of the stomach appeared, and, as the patient declined further operation, he was ultimately discharged from the Service. His condition however at the time of his discharge was very much better than when admitted.

It may be remarked in passing that the ability of an enlisted man in the navy to perform his duties on a sea-going ship is a rather severe test as to the character of the results obtained.

In the majority of these cases the effects of the operation are almost immediate and very marked. Often in a month's time the skin will have become clear, constipation will have disappeared, the patient will have begun to take on weight and will inform you that he feels like a "new man." In cases in which vomiting is a marked feature this symptom will disappear almost immediately. In all these cases, in fact, vomiting did not recur after the patient had recovered from the immediate effects of the operation.

As to the more remote results it may be mentioned that in one case the patient gained twenty-four pounds in eight months, in another, nineteen pounds in six months, and in many other cases the results were almost as striking.

The question as to the permanency of the cure in these cases is one of very great interest. It is contended by those who advocate the short circuiting and colectomy operations in all cases that the bands and membranes will ultimately reform and reproduce the obstructive conditions. We have, however, traced several cases for a year and a half now (which cases were published in a previous communication,¹) and these patients have remained in excellent health, and have had no return of their stasis symptoms. Nevertheless it seems unquestionably true that in a very small percentage of late cases, such as certain cases in which the cæcum and ascending colon are very large and freely movable, in which the transverse colon is prolapsed, in which the obstruction can be demonstrated at the splenic flexure or in the

¹ ANNALS OF SURGERY, January, 1914.

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sigmoid, such operations as colectomy or short circuiting seem to offer the only hope of a permanent cure. I have seen several of these late cases with Bainbridge of New York, in which colectomy or short circuiting was done by him with very gratifying results. However, cases in which these radical procedures are necessary I believe are the rare exception. In none of twenty-five cases operated during the past two years did a short circuiting or colectomy seem indicated. A complete cure or great improvement occurred in practically all these cases, operated according to the conservative methods above outlined.

REPORT OF CASES

CASE I.—L. C. A., age twenty-four years. Admitted December 5, 1913.

History of first attack of abdominal pain, eleven years ago, diagnosed appendicitis, and of five or six attacks of cramps with localized right iliac tenderness since that date. For the past year or more there has been marked constipation with occasional attacks of diarrhoea. Has had frequent headaches and has felt listless, dull, and heavy. A thin, tired-looking man with a muddy, sallow complexion. Examination shows moderate tenderness in the right iliac region and more marked tenderness over the hepatic flexure. Radiographs show marked stagnation of bismuth in the ascending colon.

Operation (December 24, 1913).—Gas-ether, right rectus incision. A thickened appendix removed and stump inverted. At the hepatic flexure there was a rather limited Jackson's membrane, which was causing marked angulation and obstruction. This was divided transversely and sutured longitudinally.

February 10, 1914: Discharged. Headache, malaise, and local tenderness have disappeared. Bowels move once daily without purgatives. A note from this patient on August 10, 1914, seven and one-half months after operation, stated that he had gained twenty-four pounds in weight and felt better in every way.

CASE II.—T. M., age twenty-one years. Admitted December 30, 1913.

History: A year before admission had an attack of epigastric pain and frequent vomiting lasting two weeks or more. Six weeks before admission had epigastric pain increasing in severity for four days, when vomiting commenced and recurred once or more each day until he was admitted. Since admission he has vomited frequently, practically whenever food was taken. Examination shows marked tenderness over the appendix and less marked in the epigastrium. Bismuth radiograph shows large part of the bismuth meal in the terminal ileum at the end of nine hours.

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Operation (January 6, 1914).—A thickened and indurated appendix was removed and a typical ileopelvic band causing marked angulations of ileum was divided transversely and united longitudinally. Uninterrupted recovery. Did not vomit after operation.

This patient was last seen on October 12, 1914. He had gained in weight and looked well. There was, however, pain after meals and other symptoms strongly suggestive of ulcer. He declined further operation and was discharged from the Service.

CASE III.—L. T., aged forty-two years. Admitted December 30, 1914.

History that six years ago he had an attack of epigastric pain, vomiting, and constipation, lasting two months. Since this time such an attack would occur every four or five months. Constipation a marked feature throughout. For two weeks before admission he had vomited repeatedly and had taken no food. On admission examination showed tenderness over the appendix region and to a much less degree in the epigastrium. By January 5, vomiting had ceased and the tenderness was more localized over the appendix area.

January 20: Radiograph shows marked nine hours stasis in terminal ileum.

January 26: On opening the abdomen the appendix was found to be thickened and firmly adherent to the under surface of the mesentery of the ileum, causing a marked angulation of ileum about two inches from ileocaecal valve. The removal of the appendix corrected this condition.

February 27: Greatly improved. No vomiting or pain since operation. Bowels moving regularly without purgatives. Has gained ten pounds. Discharged.

CASE IV.—C. C., aged twenty-three years. Admitted February 9, 1914.

History: December 6, 1914, pus appendix drained, appendix not removed. Appendix removed March, 1914. Since this date there have been frequent attacks of abdominal pain referred to the appendix region with occasional vomiting.

Bismuth radiograph shows stagnation of bismuth in terminal coils of the ileum at the end of nine hours.

Operation (February 16, 1914).—Right rectus incision through scar of former operation. Adhesion of omentum and of ileum to caecum separated, raw surfaces covered in and smeared with vaseline.

March 27: Discharged. All symptoms relieved.

CASE V.—A. L. D., aged thirty years. Admitted February 27, 1914.

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History: Trouble began rather acutely five and one-half years ago with vomiting on arising in the morning and after each meal. Following such attack there would be epigastric pain. Since the outset of the trouble there has been very marked constipation requiring daily purgatives, and he has lost weight (from 190 to 130 pounds).

On admission complexion ruddy, weight 135 pounds. There is a marked tenderness over the appendix region with slight tenderness in epigastrium.

Bismuth radiograph (Fig.1) shows marked nine-hour stagnation in terminal coils of ileum with puddling. The kink is plainly to be seen in the radiograph. Was kept under observation for two weeks during which time he vomited several times a day. This was accompanied with marked constipation. At operation, an appendix, long and free, with no evidence of inflammation, was removed. A short and thick ileopelvic band bound the ileum, at a point about two inches from the valve, to the right iliac fossa, so that the gut could not be lifted from the fossa for a distance of more than one inch. This was divided transversely and sutured longitudinally.

May 1: Recovery was uneventful. All symptoms relieved. Bowels move regularly without purgatives. Radiograph (Fig. 2) taken nine hours after a bismuth meal shows the head of the column has reached the rectum. No bismuth in terminal coils of ileum. Six months after operation patient was examined. He had gained fifteen pounds and his bowels were moving naturally once daily. Vomiting had occurred but once or twice since the operation, and then probably due to some indiscretion of diet.

CASE VI.—F. J., aged thirty-four years and six months. Admitted March 13, 1914.

Present trouble began eight years ago with gradually developing pain in "pit of stomach" and constipation. Has had attacks of epigastric pain and marked constipation since this time, requiring purgatives three to four times a week. There have been intervals of a week or two when there was no pain. Vomiting occurred frequently, sometimes several times a day, and at such times constipation was marked. When the bowels would move there would be no vomiting. Has lost about ten pounds since trouble started. About half the time felt "dopey" and without energy.

Examination: Fairly well developed, sallow man. Abdominal palpation shows tenderness in epigastrium to right of mid-line and over appendix region. Most marked at the latter point.



FIG. 1.—Case V. Radiograph nine hours after bismuth meal, showing ileal stasis with pudding; kink at point X. At operation unusually well developed Lane's kink.



FIG. 2.—Case V. Same after operation. Radiograph taken nine hours after bismuth meal shows that the obstruction has been entirely removed.

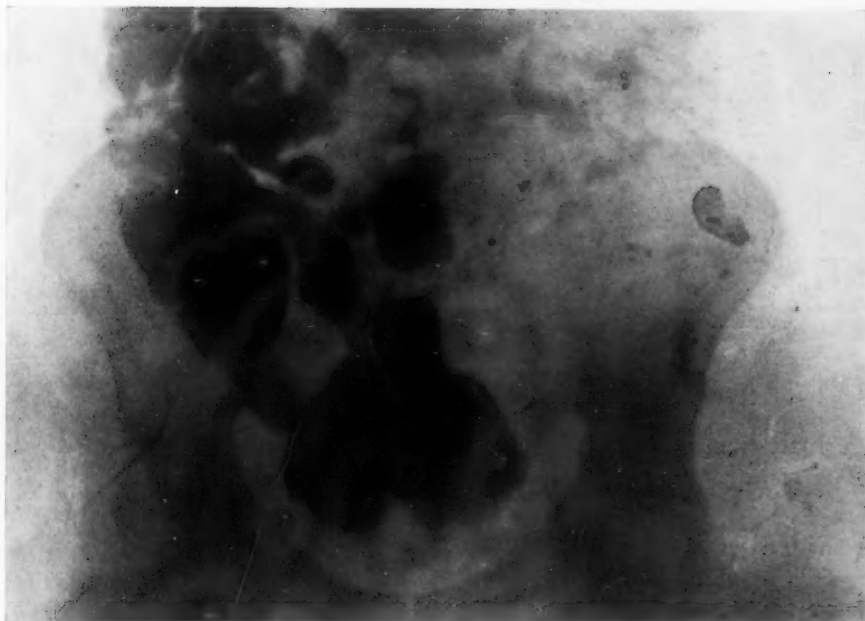


FIG. 3.—Case XII. Plate 7. Radiograph taken nine hours after bismuth meal, showing ileal stasis and puddling. At operation Lane's kink. Ileopelvic band attached at the point marked X.

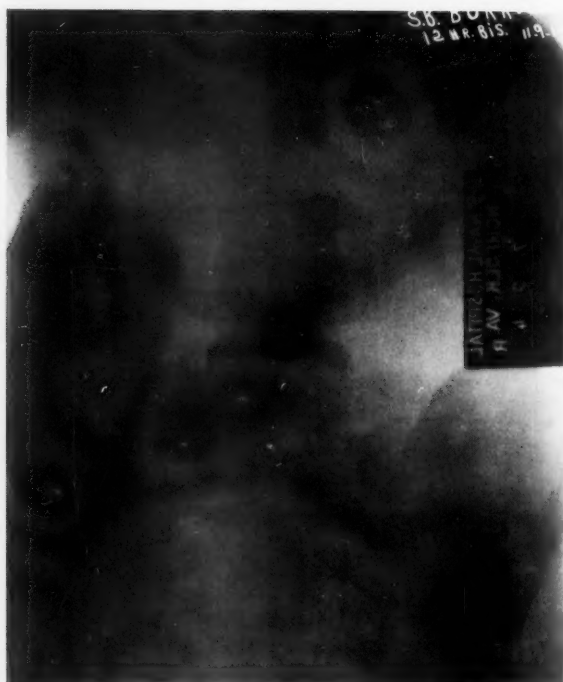


FIG. 4.—Case XV. Plate 11. Radiograph taken twelve hours after bismuth meal, showing obstruction at hepatic flexure. At operation Lane's kink and Jackson's membrane. Obstruction in terminal ileum and at hepatic flexure.



FIG. 5.—Case XV. Plate 12. After operation. Radiograph taken twelve hours after bismuth meal, showing that obstruction at the hepatic flexure has been relieved. Head of bismuth column has reached the sigmoid, very small amount of bismuth still present in terminal coils of ileum.

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Pain never referred to the appendix. Radiograph shows stagnation of bismuth in terminal coils of the ileum after nine hours.

Operation (March 30).—The appendix was found to be somewhat thickened and adherent to the under surface of the mesentery. It was removed. A well-marked Treves' ligament was present which evidently caused angulation of the ileum within an inch of the ileocaecal valve.

April 16: Discharged. Bowels move daily without purgatives. There has been no vomiting since operation. Has gained fifteen pounds.

CASE VII.—K. H., aged twenty-four years and six months. Admitted March 25, 1914.

Present trouble began about two years ago with constipation and attacks of dull epigastric pain relieved by purgatives. This condition has grown steadily worse. During the past six months there have been three of these attacks with quite severe epigastric pain. There has been occasional headache during this period and periods of a "dopey," "good-for-nothing" feeling. On admission a well-developed, well-muscled man, complexion sallow. At present complains of slight epigastric pain and constipation. Examination shows slight tenderness in epigastrium and moderate tenderness over the appendix. Bismuth radiograph shows marked stagnation with puddling at the end of nine hours.

Operation (April 20).—The appendix normal in appearance lying to the outer side of the caput coli, is removed. An unusually well-developed ligament of Treves evidently caused angulation and obstruction about two inches from the ileocaecal valve.

Discharged June 30, 1914. Constipation was relieved. Condition otherwise was about the same.

CASE VIII.—N. B. O., aged twenty-nine years and 6 months. Admitted March 26, 1914.

History: Operation for appendicitis in April, 1910. Following this operation felt well until about two months before admission, when right iliac pain and vomiting came on suddenly and very severely. This attack lasted about one week. About a month before admission had attack similar to the first, lasting four or five days.

Well-nourished, fairly-healthy looking man of twenty-nine years. Examination shows scar of operation near Poupart's ligament and some tenderness over the appendix region. Since one week after the attack of two months ago, patient has been extremely constipated. Bismuth radiograph shows nine hours stagnation in terminal ileum.

Operation (March 4).—A short, thick, and indurated appen-

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dix removed. A well-developed ileopelvic band divided transversely over the iliac vessels and the rent united longitudinally. The band bound the terminal ileum close to the pelvic wall.

August 14, 1914: Patient examined on this date. Greatly improved since operation, and has gained in weight. Bowels move regularly.

CASE IX.—J. H. P., aged forty-two years and six months. Admitted April 3, 1914.

When about twenty-one years of age had very severe attacks of abdominal cramps lasting forty-eight hours or more. Five years ago had attack of pain in upper abdomen lasting two months.

Four years ago (fall 1910) had a somewhat similar attack, beginning in upper epigastrium and working over toward the right side. Continued to have this pain without nausea or vomiting until June, 1911, when gall-bladder was explored and normal condition was found. Patient was informed that his appendix had been removed. Improvement following this operation until one and one-half years ago when he began to have pain in pit of the stomach, not connected with taking of food, but sometimes relieved by food. There has been very marked constipation for the past two years, requiring a purgative twice a week at least. During this period he has felt weak, has had more or less constant pain across the back, and has been without "any energy at all." Has lost fourteen pounds in the past two years. Chief complaints are, epigastric pain and constipation, constant belching of gas, and loss of energy.

Examination shows a fairly well-nourished, sallow man, of forty-two years. Over the appendix region there is marked tenderness on deep pressure. There is slight tenderness over gall-bladder. Radiograph taken nine hours after the bismuth meal shows stagnation and puddling in the terminal coils of the ileum.

Operation (April 20).—A well-developed ileopelvic band was found attaching the ileum at a point about three inches from the valve to the wall of the fossa over the iliac vessels. This band was divided transversely, the peritoneum loosened up from the underlying connective tissue, and the rent untied longitudinally. This procedure completely freed the ileum. The appendix had been removed at the former operation.

This patient was discharged to duty May 27. He had gained five pounds; bowels were moving regularly without purgatives. He states that he felt like a "new man." He was examined September 15, five months after the operation. He had gained twelve pounds, appeared in robust health, his skin was clear and he had no complaints.

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CASE X.—G. M. R., aged twenty-two years and nine months. Admitted May 11, 1914.

History of an operation for acute appendicitis in May, 1913. Fairly good health followed this operation until about six months ago, when he had an attack of pain in the right iliac region with nausea. These symptoms increased in severity so that for the past two or three months there has been continuous pain in the right iliac region, with frequent attacks of vomiting. There has also been rather marked constipation. Bismuth radiograph shows marked nine-hour stasis in terminal ileum.

Operation (May 11, 1914).—Extensive adhesions of the cæcum to parietal peritoneum, and of the omentum to both the cæcum and the parietal peritoneum were found. These were carefully separated, all denuded surfaces covered with peritoneum and liberally smeared with vaseline. A portion of the adherent omentum definitely obstructed the ileum near its termination.

This patient made an uncomplicated recovery and was constantly under observation until December 1, 1914. All symptoms were completely relieved by the operation and there was a normal daily bowel movement.

CASE XI.—C. D. F., aged nineteen years. Admitted June 18, 1914.

Had been operated for double hernia, December 16, 1913, history otherwise negative. About six weeks after the operation for hernia, began to have constipation. Bowels would not move for three or four days at a time and not then unless purgatives were taken. About the same time there was first noticed abdominal pain coming on almost daily, and felt to the left of the umbilicus. Felt dizzy, eyes would become blurred, and had one attack of fainting. These symptoms continued until date of admission.

On admission June 22, 1914, fairly well-nourished, healthy looking boy of nineteen years, with a tired look about the eyes. Examination negative, save for slight tenderness over region of the appendix. Bismuth radiograph showed marked nine-hour stasis.

Operation (August 24, 1914).—The abdomen was opened and a normal looking appendix removed. A typical Lane's band was divided transversely and the rent sutured at right angle to the line of incision.

August 25: Condition very much the same as before operation. No longer has abdominal pain, but constipation is unrelieved. Discharged as unimproved.

CASE XII.—J. A. H., aged twenty-seven years. Admitted June 19, 1914.

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Present trouble began about five years ago with constipation, headache, weakness, and attacks of pain in right iliac region. Constipation has grown steadily worse, bowels would not move for three or four days at a time. Attacks of abdominal pain would occur once every two or three weeks, confined mostly to region of the appendix. Felt listless, had no inclination to work, and had occasional headaches. Lost about twenty pounds in weight.

On admission a sallow, slightly emaciated man, of twenty-seven years. Complains of constipation, headache, and general malaise. Examination shows slight local tenderness over the appendix region. Bismuth radiograph (Fig. 3) nine hours after meal shows stasis of the bismuth in the terminal coils of the ileum and puddling.

Operation (June 24, 1914).—A typical Lane's kink present. This was corrected by dividing the ileopelvic band and suturing at right angles to the line of incision. A normal appendix removed.

August 28: Discharged. Bowels move once or twice a day without purgatives. Feels like a "new man." Has gained eight or more pounds. The improvement in the general appearance of this patient was remarkable.

CASE XIII.—J. G. T., aged twenty-seven years. Admitted August 1, 1914.

Present trouble began about two years ago with loss of appetite and regurgitation of food which was soon followed by frequent attacks of abdominal pain, at first occurring daily, later there would be no pain for several weeks or a month. Very shortly after the onset of these symptoms the patient noticed that he had become markedly constipated. For the past two years has taken purgatives almost constantly.

The symptoms enumerated, with slight remissions and exacerbations, continued until time of admission.

When admitted, August 1, 1914, he was a rather thin, anæmic, sallow man, complaining of loss of appetite, constipation and pain in the region of the appendix, and that he feels "dopey," and wants to sit down all the time. Is evidently suffering from a rather severe intestinal toxæmia. Weight 119 pounds.

Examination shows well-marked tenderness over the appendix, fairly well localized. Bismuth radiograph shows marked stasis at the end of nine hours with puddling.

August 6: Abdominal exploration. A normal appendix was removed. A well-marked Lane's band was found attached about two inches from the ileocæcal valve and producing marked

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kinking at this point. It was divided transversely and united at right angles to the line of division. This procedure apparently entirely relieved the obstruction. Before the band was divided the contents of the intestine could only with difficulty be pushed past the kink.

The patient was discharged September 4, 1914, twenty-nine days after operation. He had gained six pounds and his general appearance had entirely changed. From a sallow, unhealthy looking individual he had become a ruddy, healthy man. His subjective symptoms have entirely disappeared and he states that he feels like a "new man." His bowels are moving once or more daily.

The patient was seen five months after operation. He had gained nineteen pounds and was in perfect health.

CASE XIV.—E. L. T., aged thirty-five years. Admitted October 9, 1914.

Past history of an attack, about three years ago, of abdominal cramps, vomiting and vertigo. Following this attack felt well and enjoyed excellent health until about seven weeks ago, when, following a straining effort, he experienced a severe pain in the region of the appendix. Soon after this pain was felt, vomiting occurred and has been repeated since this date practically after every meal. There has been a loss of weight of twenty-six pounds during the past five weeks. Bismuth radiograph shows marked nine-hour stasis in terminal ileum.

October 21, 1914: Abdominal section. The terminal ileum found to be tightly bound to the right iliac fossa by two bloodless bands of peritoneum extending from the surface of the fossa in the neighborhood of the anterior iliac spine to the mesenteric border of the ileum. Free division of these bands and undermining the adjacent peritoneum completely liberates the ileum. The defect in the peritoneum thus produced is corrected by uniting the peritoneum at right angles to the line of the division of the bands. A retrocaecal appendix showing no evidence of inflammation removed.

October 26, 1914: Uneventful recovery, has not vomited since operation.

December 29: Discharged. Vomiting has not recurred. Has gained ten pounds. Bowels move regularly without purgatives.

CASE XV.—S. B. B., aged twenty-three years and five months. Admitted November 4, 1914.

History: About six months ago had severe attack of abdominal pain lasting two or three days. Was transferred to hospital and remained four months, during which period attacks of abdominal pain and vomiting frequently occurred.

After return to duty attacks of abdominal pain continued until date of admission with occasional vomiting. During this period was slightly constipated. During the whole period felt heavy and dull, was in a "doped-up" condition, and had frequent headaches. Lost about fifteen pounds in weight. Examination shows tenderness over the appendix region and at the hepatic flexure.

Nine-hour bismuth radiograph shows stasis and "kink" in terminal ileum, and twelve-hour radiograph (Fig. 4) shows obstruction and abnormality at the hepatic flexure.

November 7, 1914: Abdominal section. Marked kinking of ileum corrected by dividing an ileopelvic band transversely and uniting the defect longitudinally. Appendix removed. An extensive Jackson's membrane present at hepatic flexure, several thickened bands of which cause obstruction and deformity in the neighborhood of the flexure. These thickened bands are divided and resulting small raw surfaces smeared with sterile vaseline. It was evident that the bands cause very considerable obstruction. There were no adhesions in the ordinary sense.

December 9, 1914: Uninterrupted recovery, bowels moving regularly, no headache or pain. Complexion has cleared up considerably.

January 5, 1915: Discharged. General condition greatly improved, complexion almost ruddy. Has gained fourteen pounds. Radiograph (Fig. 5) shows obstruction at hepatic flexure relieved.

CASE XVI.—I. N. S., aged twenty-six years and three months. Admitted November 4, 1914.

History: Operated for acute appendicitis in June, 1907, and for adhesions in July, 1908. Had no further trouble until June, 1913, when, after lifting, felt severe pain in right iliac region which was followed by constipation and right iliac pain for about three weeks. He then had no further trouble until three months ago when severe pain was felt in right iliac region which has grown steadily worse, and has been accompanied by marked constipation. Bismuth radiograph shows marked nine-hour stasis. Examination shows marked tenderness in the region of McBurney's point.

November 16, 1914: Abdominal section. The following conditions were found: Adhesions of omentum to right iliac fossa, a band of omentum compressing the ileum. Adhesions of the omentum to parietal peritoneum to the outer side of the ascending colon. This adhesion caused marked obstruction of the ascending colon about three inches from the hepatic flexure. Extensive adhesions between caput coli and right iliac fossa.

All adhesions were carefully separated, omentum ligated where necessary, raw surfaces covered with peritoneum and all lines of

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separations of adhesions liberally smeared with vaseline. Recovery uneventful.

December 20, 1914: Bowels moving regularly, feels better in every way. Complexion has cleared markedly.

December 31, 1911: Has gained four pounds. Patient states that he never felt better in his life.

Bismuth radiographs taken December 30 show that his stasis has been practically entirely relieved.

CASE XVII.—J. F., aged forty-one years and seven months. Admitted November 4, 1914.

History of occasional attacks of pain in the region of the appendix, particularly after slight exercise and when constipated. Has had several of these attacks in the past four months. Constipation has been marked for the past three years, for which he has taken purgative pills almost daily.

On admission a fairly well-developed man of forty-one years. Examination shows rather marked tenderness just below and to the inner side of McBurney's point. Bismuth radiograph shows nine-hour ileal stasis and stasis in the ascending colon.

November 16, 1914. Abdominal section. A thickened appendix was removed. No Lane's kink. There was present a well-developed Jackson's membrane causing marked angulation and obstruction at the hepatic flexure. This was freely divided transversely in the region of the flexure and the defect thus produced sutured at right angles to line of division. The cæcum was large and freely movable. It was fastened to the lateral abdominal wall by three Pagenstecher stitches through the external longitudinal band.

This patient was discharged to duty January 25, 1915. He had gained thirteen and one-half pounds and felt better than he had for ten years. His bowels moved daily without purgatives.

CASE XVIII.—T. H. B., aged twenty-one years and four months. Admitted November 9, 1914.

Past history: The appendix was removed at the Pennsylvania Hospital, Philadelphia, January 3, 1912. Was entirely well for six months when pain was noticed in right iliac region and patient noticed that he was becoming constipated. Six months later or about one year ago the constipation had become marked. When constipation was especially severe there would be marked pain in right iliac region. Improvement then occurred until about six months ago when constipation and right iliac pain returned and have been growing steadily worse. Has taken purgatives constantly. Bowel movement would give immediate relief of pain. Lost about thirty pounds in weight.

On admission a thin, sallow man of twenty-one years with

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heavy circles under the eyes. A picture of intestinal toxæmia.

Examination shows marked tenderness over the appendix region and slight tenderness in epigastrium and over the hepatic flexure. Bismuth radiograph shows marked nine-hour delay in terminal ileum and some delay at hepatic flexure.

November 23, 1914: Abdominal section revealed a typical Lane's band causing marked angulation. This was divided transversely, peritoneum undermined and incision united longitudinally. The marked kinking of the ileum was thus completely corrected. A membrane stretched from the termination of the ascending colon to the first portion of the transverse colon caused marked angulation of the hepatic flexure. This was divided and the raw edges liberally smeared with vaseline. The appendix had been removed at first operation and there were practically no post-operative adhesions in the usual sense.

December 8, 1914: Uncomplicated recovery, bowels moving daily, complexion decidedly clearer.

January 8, 1915: Discharged. Very much improved.

CASE XIX.—J. J. S., aged thirty years and four months. Admitted November 27, 1914.

History: Was operated for chronic appendicitis December, 1913, appendix removed. About a month or more after the operation began to have "sick spells" and headache. From this time on had frequent slight attacks of epigastric pain, especially when a straining effort was made. About a week before admission had a very severe attack of epigastric pain which persisted until he was admitted. Has had no constipation.

On admission complains of very severe epigastric pain. Examination shows rather marked tenderness over the appendix region. Bismuth radiograph shows nine-hour stasis in terminal ileum.

December 14, 1914: Abdominal section. The omentum is adherent to the right iliac fossa compressing the ileum near its termination. The caput coli is firmly adherent to the right iliac fossa. The omentum was divided, adhesions separated, raw surfaces covered with peritoneum and liberally smeared with vaseline. Uneventful recovery; allowed up.

January 8, 1915: To duty, greatly improved. Patient states that he has not felt so well in the past year.

DIPHThERIAL AND PSEUDODIPHThERIAL PRIMARY CUTANEOUS INFECTION*

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WE find, after a rather careful review of the literature, that primary cutaneous diphtheria, unassociated with infection of the mucous membrane by the Klebs-Löffler bacillus, is an unusual condition. I also am unable to find any report of case or cases of primary cutaneous diphtheroid infection, or infection due to the pseudodiphtheria bacillus, as proven by animal inoculation. A number of wound and complicated abscess infections of the pseudo-bacillus type have been reported and successfully treated with vaccines by Heath. There is such a close relationship between diphtherial and pseudodiphtherial infections of the mucous membranes, where they have been heretofore compared, that a reference to cutaneous diphtheria must first be made, cutaneous involvement secondary to faucial, nasal, conjunctival, or vaginal diphtheria is seen much more frequently. However, this is not an extremely common condition, as shown by the statistics compiled by Filatow from St. Anne's Hospital, Vienna, from 1894 to 1902, where only 23 cases were seen among 2217 diphtheria patients treated. The infection in this type of cutaneous diphtheria occurring secondarily to mucous membrane infection takes place first by continuity of structure from mucous membrane to skin—as in extension from the nares on to nose and lips, as in vaginal extension to the external genitalia—or, as is occasionally seen in the laryngeal type, with an extension from a tracheotomy wound on to the surface of the neck; and, second, by transplantation of the bacilli to distant parts, the implantation occurring on an abraded surface, a scratch or a blister as in one of the cases reported by Guthrie, who, while suffering from a faucial diphtheria, developed pneumonia, for which he was blistered on the back, and subsequently developed cutaneous diphtheria at the site of the blister. A number of cases illustrating this type have been reported. McCollom states that diphtheritic lesions of stomach and duodenum are occasionally found. Durk, Gunther and Müller have reported intestinal cases, and Schodel has isolated the diphtheria bacillus from the feces; these findings might explain the few cases of perianal diphtheria on record. The perianal region in infancy or early childhood is frequently the site

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of excoriations, intertrigo, eczema, etc., which are etiological considerations in the development of such a lesion.

I have found reports of 25 cases of primary cutaneous diphtheria without simultaneous or subsequent mucous membrane involvement, and in order to make clear the clinical appearances with which the infection may clothe itself, it is necessary to recall, in a brief way, portions or extracts of the clinical reports of some of these cases.

Bolton and Schöttmuller report diphtheritic ulcers in groins of two children under two years of age; Bolton's case developed extensive paralysis. Heelis and Jacob make a most interesting report of four cases from the same dormitory of an orphanage, which had been quarantined on account of a case of faucial diphtheria. Two of these patients were suffering from frost-bitten blisters on dorsum of toes, a third from the same condition on her heel; all three developed cutaneous diphtheria at the named locations; the fourth developed a similar lesion on the dorsum of her hand. Hassenstein, Toch, Freymuth, and Petrusky report diphtheritic ulceration of the umbilicus in infants. Fleisch's case was that of an infant, 2½ months old, previously burned, who was kissed by a person suffering from diphtheria of the throat. Patterson's case concerns a young woman with a lesion on her right forefinger, who subsequently developed paralysis of all extremities. Gunther reports a case in a girl, two years old, suffering from an acute phlegmon of the abdominal wall with vesiculation resembling erysipelas. Ehrhardt reports 3 such cases without mucous membrane involvement, and 1 with subsequent throat infection. Sowade's case showed multiple ulcers on the right arm and thorax, soon after vaccination, in a child of nine months. Guthrie quotes Rosenthal, as follows, in describing the death of Griesinger: "A perityphlitic abscess had been opened, which subsequently became infected with Klebs-Löffler bacillus after it had healed. He later developed a wide-spread paralysis involving all extremities, speech, deglutition; dying on the seventieth day from respiratory paralysis." Post's case was that of an adult male, who had cared for his brother-in-law, wife and child during their illness from diphtheria. His lesion was on the foreskin, complicated with an acute phimosis, and was 4 weeks old on his entry to the hospital. A dorsal incision, having been made by his physician, was covered with the diphtheritic membrane, from which bacilli resembling morphologically the diphtheria bacillus were obtained, but not until bilateral ciliary and paralysis of all extremities had supervened. McCallom adds that several similar cases have been observed at the South Department of the Boston City Hospital, and that diphtheria of the penis is more frequent than is generally supposed. Kerr, Sack, Gerloczy, Dutschlander and Schucht have observed cases of cutaneous diphtheria unassociated with mucous membrane infection, in addition to these just referred to. There have been reported by Toch, Freymuth, Petrusky and Reichold, Veiel, Sharp and Bertelli, 5 cases of primary cutaneous diphtheria, with secondary mucous membrane infection. In Sharp's case the lesions were multiple over the chest and face, with secondary involvement of the throat; Bertelli's case, confirmed by animal inoculation, was a colleague who had a blister on the upper lip while treating a case of diphtheria of the throat; the blister became the seat of a diphtheritic infection, covered with membrane, and subsequent throat infection, which yielded promptly to antitoxin subcutaneously, without causing improve-

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ment in the cutaneous lesion (to this he applied Bandis bivalent serum; the wound healed in a few days). Slater reports a case of 3 years' duration in a female, with multiple lesions on the body, probably originating in the conjunctiva, with later ear and vaginal involvement. The case had received all sorts of local treatment and had been under antisyphilitic treatment for 2 years. Finally, after careful bacteriological study, the cause was determined, and treatment by the use of antitoxin subcutaneously instituted. At the end of 5 weeks, all lesions had healed and the patient was considered cured.

CASE REPORTS

CASE I.—I wish to add the report of a male, forty-seven years old, school janitor, referred to Dr. Gibbon's service at the Jefferson Hospital by his physician, Dr. Roberts, of Llanerch, Pa. About November 12, he was helping to fumigate, and scrubbing the floor of a school then quarantined, on which a child supposed to be ill with diphtheria had vomited. During this time he suffered an abraded wound of the left middle finger on the dorsum of the second phalanx, a "blood-blister" resulting. Two days later, yellowish-gray streaks appeared about the wound, with pain, swelling and stiffness of the distal joint. On the third day, his physician incised it, applied antiseptic dressing, and later flaxseed poultices; at the end of a week, a membrane or grayish slough had appeared. Similar treatment was continued for some time at the Dispensary of the Jefferson Hospital, without improvement. He was suffering slight constitutional disturbance, vague, shifting pains over body and extremities, with loss of appetite. Two Wassermann reactions had been done and found negative. The wound at this time was covered with a dirty, yellowish-gray slough, fibrous and adherent, extending down to the extensor tendon. The edges were slightly elevated and indurated, presenting an indolent appearance, and covering all of the dorsal surface between the second and third joints (Fig. 1). At this time Dr. Rosenberger was asked to make bacteriological studies, and his report is as follows: "Inoculations were made from the wound upon agar and incubated for 24 hours at 37° C.; at the end of this time, an abundant growth developed, which was of a light lemon-yellow color; spreads made and stained with Löffler's methylene blue, and by Groves method, showed bacilli (Gram-positive) possessing the morphology of diphtheria bacilli, together with few staphylococci; a guinea-pig was inoculated with 2 c.c. of a 48 hour old bouillon culture, which was absolutely negative as to tonic effects. In bouillon, the growth was manifested by a sediment, in gelatine no liquefaction nor gas production. A vaccine was made from a 24 hour old growth upon agar, and each cubic centimetre of vaccine contained approximately 500 million bacilli; 1 c.c. of the vaccine was given at a time, and four doses were

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given at four-day intervals, the patient soon began to improve and the wound healed without further trouble."

CASE II.—A girl of seventeen years, with lesion on dorsum of left index finger, almost encircling it, between second and third joints (Fig. 2), began six weeks before admission to Pennsylvania Hospital, Out-patient Department (service of Dr. Stewart), which was January 19, 1915. The trouble began with a pin-scratch; she was treated at another hospital for four weeks, and by her physician, Dr. Hickby, who referred her to the hospital, for two weeks. The wound edges were sharply defined and slightly elevated, showing some redness and induration; the surface of the wound was covered with the characteristic grayish fibrous membrane, and was difficult to remove, which exposed the extensor tendon and matrix of the nail. She had slight constitutional symptoms, with little elevation of temperature that was never recorded above 100° , and the pain seemed less than in the usual acute infection.

Bacteriological examination showed bacilli possessing the morphological characteristics of the Klebs-Löffler bacillus with a few staphylococci. The treatment consisted in the local use of diphtheria antitoxin in the form of a wet dressing on gauze covered with rubber dam to maintain moisture. This dressing was changed every 24 hours for 5 days, when the membrane had disappeared, leaving a clean granulating surface, which healed in about 4 weeks. Unfortunately, the first culture was destroyed before animal inoculation was done, and we were unable to get another after the employment of the antitoxin in spite of repeated efforts.

A summary of the review of these cases of cutaneous diphtheria would seem to show that it is usually secondary to mucous membrane diphtheria; that primary cutaneous diphtheria is an infrequent infection which may manifest itself in a single lesion, or in multiple concomitant lesions distributed over a wide area, or in the form of cutaneous and subcutaneous phlegmon, with considerable induration without marked pain, and without fluctuation or suppuration, if not complicated with pyogenic bacteria; and, finally, it may appear in the form of cellulitis with vesiculation resembling erysipelas. The infection is most apt to take place in wounds offering the most blood serum for the growth of the bacillus, as in blisters. Paralysis, as in other forms of diphtheria, is not an unusual complication, or sequel, and is usually widespread. We also find that pseudodiphtherial cutaneous infection occurs as it does on mucous membranes, and the clinical picture presented is identical with that of cutaneous diphtheria, and cannot be differentiated



FIG. 1.—Case I. Diphtheritic ulcer of finger.

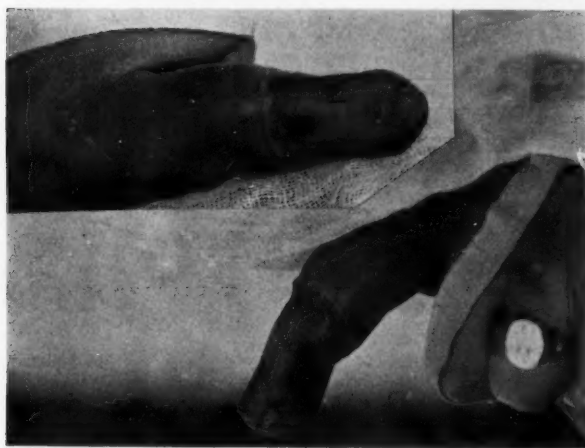


FIG. 2.—Diphtheritic ulcers of finger (condition presented in Case II).

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except by animal inoculation. It is obvious that the clinical manifestations resulting from cutaneous infection by the diphtheria bacillus may be as diverse as the changes of environment governing the infection, which only make the appearance of the lesion or lesions more deceptive to the diagnostician. Hence the ease with which it has been mistaken for some of the syphilitic lesions, a tubercular process, a phlegmon, or some widespread skin affection. The treatment of cutaneous diphtheria resolves itself into that of diphtheria of any other part, viz.: the use of antitoxin subcutaneously or locally, or both, and for pseudodiphtherial skin infections, the use of the autogenous vaccines would seem to be the treatment of choice, and, of course, local surgical cleanliness in both conditions.

I am deeply indebted to Doctors Gibbon and Despard for the privilege of reporting the first case, and to Dr. Stewart for the privilege of reporting Case II, and to Dr. Rosenberger for his careful bacteriological study and the preparation of the vaccine in Case I.

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TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

Stated Meeting, held March 24, 1915

The President, DR. FREDERIC KAMMERER, in the Chair

EXCISION OF SUPERIOR MAXILLA

DR. ROBERT T. MORRIS showed a young man about twenty-nine years of age, who, 10 years previously, had had the superior maxilla removed for a sarcoma which was growing rapidly. The post-operative deformity was distressing; the eye had a tendency to drop and the cheek to sink. An apparatus was made which has supported the cheek, and, in addition, Dr. Douglas injected paraffin and as a result there is now little to indicate that so extensive an operation had been performed. Jaws are used just as normal in eating. Dr. Morris pointed out that he made the classical incision but unusually extensive removal of bone.

PARTIAL RESECTION OF LOWER JAW

DR. EDWARD M. FOOTE presented three patients showing the effects of partial resection of the lower jaw for epithelioma.

In the first patient the right side of the jaw was disarticulated for epithelioma of the inside of the cheek, not involving the bone. Glands in the neck were also removed, but did not show epithelioma. There was paralysis of the lower lid of the eye, which has since improved.

The operation upon the second patient was performed for recurrent sarcoma in the tissues adjacent to the lower jaw, not involving the bone. A subsequent operation was necessary in the neck for a later recurrence. There was no paralysis of the eye or mouth, and motions of the jaw were good.

The third patient shown had a very extensive epithelioma of the posterior portion of the left side of the lower jaw, involving the inner side of the cheek, the floor of the mouth, the side of the tongue, the soft palate and the anterior pillar of the fauces. After operation this patient for a time was unable to open his mouth owing to the extent of scar tissue, but this gradually softened so that eight months later, at the time of presentation, the incisor teeth could be separated about an inch.

HEMORRHAGE FOLLOWING GASTRO-ENTEROSTOMY

CONGENITAL LUES OF STOMACH

DR. WILLIAM A. DOWNES presented a girl about sixteen years of age, who came under his care when she was fourteen years of age. A diagnosis of congenital lues of stomach was easily established. Wassermann was four plus positive. She was vomiting at that time continuously. After one injection of neosalvarsan, a posterior gastro-enterostomy was done. Then for some time he lost track of her. However, she turned up again and treatment has been resumed. Although not remarkably robust she now feels quite well; eats everything, and her vomiting has ceased.

Dr. Downes also presented a boy who, after having been treated at the Rockefeller Institute for five or six weeks with salvarsan, and a diagnosis of appendicitis and lues had been established, was referred to St. Luke's Hospital, on account of constant pain in the stomach. An X-ray taken at St. Luke's showed a luetic condition of the stomach. Instead of being operated upon he was given a diet, and medication continued. He immediately began to improve. He weighed only 66 pounds and was undersized. He has taken on growth, now weighs 97 pounds and is in every way satisfactory. As the pylorus remained patent and the stomach emptied in the usual time, as shown by X-rays, operative intervention was not necessary.

HEMORRHAGE FOLLOWING GASTRO-ENTEROSTOMY

DR. WILLIAM A. DOWNES, in showing a case of gastro-enterostomy, said he did so on account of the rarity of severe hemorrhage following the operation. A man, aged forty-two years, was admitted to St. Luke's Hospital, February 18, 1915, with a diagnosis of duodenal ulcer, and was operated upon March 1, a posterior gastro-enterostomy and an appendectomy being done. The anastomosis was made with clamps, and the usual two-row method of suture; the outer being Pagenstecher thread and the inner oo chromic catgut. The inner suture posteriorly included all coats of the stomach and intestine, and was twice interrupted. The anterior portion of this suture was introduced by the continuous self-inverting method. The needle entered and emerged from the stomach wall at points as close together as possible. It was especially noted that the stomach wall was unusually thick and the possibility of hemorrhage was discussed at the time. For this reason two or three reinforcing mattress stitches were taken and were so placed that visible blood-vessels on the stomach wall were included in the loop. The patient left the operating table with a pulse of 64, regular and of good force. 4 P.M., vomited 93 of bright red blood; 5.10 P.M., again

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vomited; 6 P.M., vomited the third time, 12 $\frac{3}{4}$ in amount. Pulse had increased to 114, and force had become poor. At 7 P.M. the stomach was washed out with hot water—return was tinged with blood. Twenty minutes after lavage patient again vomited a large amount of bright red blood, and at this time was given an injection of horse serum. Pulse now reached 130 and patient became restless, and showed the results of severe hemorrhage. The vomiting of blood continued in varying amounts at short intervals, and by 8 o'clock it was estimated that the amount measured and lost was fully 32 $\frac{3}{4}$.

In view of the rapidly increasing pulse rate, and its poor quality, it was thought best to reopen the abdomen and look for the bleeding vessel or vessels. At 9 o'clock, eleven hours after the operation, the abdomen was opened and a four-inch longitudinal incision made through the anterior wall of the stomach, midway between the lesser and greater curvatures. The stoma was drawn through this opening by tissue forceps placed at each angle. The posterior margin was firm and showed no bleeding, while from the anterior margin there was a continuous ooze. No definite bleeding point could be noted. A continuous suture of fine chromic gut occasionally interrupted was taken around the entire margin of the stoma, being placed about $\frac{1}{4}$ inch in depth, and probably including all coats. Gastrotomy closed in the usual way. Patient's condition was critical and he was given 1200 c.c. salt solution intravenously. Two hours after second operation patient vomited 4 $\frac{3}{4}$ of dark red blood, and for several days the stools were composed almost entirely of old blood.

The patient's condition was critical for two or three days, but since then convalescence, barring an intercurrent bronchitis, has been entirely satisfactory, and the wound has now practically healed.

LATE RESULT OF FOREARM FRACTURE IN CHILD

DR. DOWD presented a boy, fourteen years of age, to illustrate the remarkable reparative power which children's bones possess, and to emphasize the difference in the indications for open operation in adults and in children.

The boy, who was then thirteen years old, was brought to St. Mary's Hospital in December, 1913, with fracture of both bones of forearm. Efforts at reduction under ether anæsthesia were twice made, and dressings of board splints and plaster-of-Paris were applied, but, in spite of these efforts, there was a distinct overlap in the bone fragments. Fig. 1 shows the deformity after these efforts at reduction had been made. Previous experience, however, had shown that such cases do



FIG. 1.—Fracture of radius and ulna in boy of thirteen. X-ray taken after two efforts at reduction, each under ether anaesthesia. Position maintained by dressing of padded board splints and plaster of Paris.

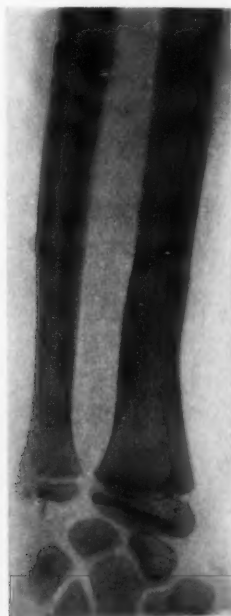


FIG. 2.—Same bones as Fig. 1. X-ray taken one year later, showing good repair of bones.



PANCREATIC CALCULI

well, and hence the plaster-of-Paris dressing was left in position and no further procedure was followed. A note was made to find and examine the patient in a year (see Figs. 1 and 2). At the end of that period one can hardly find a trace of the injury; the power of motion, the strength and the shape of the forearm are normal. Fig. 2 shows the present appearance of the bones.

Children's reparative power after fracture is so great that we should adopt two standards for fracture treatment, one for children and one for adults. It is manifest that an open operation in this child would have been an error. In certain adults, however, open operation is desirable for fractures similar to this one.

PANCREATIC CALCULI

DR. CHAS. N. DOWD said that in looking over the records of the New York Surgical Society he did not find that a single case with pancreatic calculi has ever been presented to the Society. The patient presented by him was a woman of thirty-two, who has always been well excepting for the symptoms referable to her pancreas. For several years she has had more or less epigastric pain—she began to have very severe symptoms about February 1 of last year, the attacks became very severe, necessitating the use of morphine; they were followed by the passage of small mulberry-like calculi. On the eve of March 19, her husband brought to the reporter several of these calculi and stated that her pain was unendurable and that she had been sent to the hospital for relief. She, similarly, at the hospital begged for operation. She was a strong, well-nourished woman—her temperature was normal, but she looked ill. There was a palpable epigastric mass which included the region of the gall-bladder. On operation the gall-bladder was slightly thickened but otherwise normal. There were, however, spots of fat necrosis on the omentum and there was a large boggy omental mass which extended from the gall-bladder region well over to the spleen. The gall-bladder was drained and the gastrocolic omentum over the head of the pancreas was exposed and protective gauze put about the edge of the exposed area—blunt forceps were then pushed through to the interior of the pancreatic mass and much white pus was liberated. In it there were 30 or more soft, light-colored, mulberry-like stones $\frac{1}{4}$ inch or less in diameter. A drainage tube was sewed into the opening and packing put about it. Drainage was satisfactory and the wound closed in. It reopened temporarily in the autumn, but has been well since then.

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The fluid which was discharged had a slight lipolytic ferment. The pus contained *staphylococcus pyogenes aureus*.

The calculi consisted chiefly of cholesterol and cholesterolesters. They had practically no ash and cast no X-ray shadows. These calculi differed from those which have usually been reported, in that some of them were passed by the rectum. Ordinarily, pancreatic calculi lie in the ducts—isolated in the ectasic cavities which they cause—and hence do not escape into the intestine. Oser,¹ in 1898, and Kretz,² in 1913, gave careful descriptions of them. They are very rare, usually small, light-colored, not faceted and are of moderately firm consistency, containing organic material and mercurial salts. Bacterial infection is believed to be an element in their production.

INTUSSUSCEPTION

DR. DOWD presented an infant nine months old, who was brought to the Roosevelt Hospital 20 hours after the beginning of an attack of abdominal pain. He had also vomited and had a small bloody stool. An indistinct mass could be felt in the left side of the abdomen, and a finger introduced into the rectum encountered the tip of the intussusceptum. The five classical symptoms of intussusception were thus present. Operation was done without delay and the intussusception was found to have begun at the ileocaecal valve and to have worked downward into the sigmoid flexure. It was reduced by pressure and manipulation from below without traction from above. The intestinal wall was thickened and oedematous but showed no spot of gangrene. This thickening was considered a sufficient safeguard against recurrence and no mesenteric stitches were taken. The abdominal incision was closed without drainage and the child made an excellent recovery.

A second case was presented which was almost the counterpart of the first. The child, however, was three years older; the symptoms had begun 28 hours before admission to the hospital and the intussusceptum could not be reached by the examining finger in the rectum.

Dr. Dowd said that he brought these two cases of intussusception to emphasize the good result which can confidently be expected if operation is done early and to call attention to an aid in early diagnosis. The intussusception almost always occurs in the large intestine. Clubbe, in a series of 124 cases, found only one which was entirely in the small intestine. In a little child a colonic intussusception can be palpated by bimanual examination with one finger in the rectum unless it is con-

¹Oser: *Die Erkrankungen des Pancreas*. Nothnagel *Specielle Path. und Therapie*.

²Kretz: *Handbuch du Allgemein Path.*, Krehl and Marchand.

INOPERABLE RECURRENT MALIGNANT TUMOR

cealed beneath the border of the ribs. If it is so concealed the diagnosis can be made by the aid of a bismuth enema and an X-ray picture. On this basis very few intussusceptions should escape an early diagnosis.

INOPERABLE RECURRENT SARCOMA OF THE UPPER JAW SUCCESSFULLY TREATED WITH MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS

DR. WILLIAM B. COLEY presented a woman, from whom, on June 4, 1914, Dr. J. H. Glass, of Utica, N. Y., had removed the left superior maxilla, including the left lower orbital plate, for sarcoma. The diagnosis was confirmed by microscopical examination made by Dr. Gifford of Utica. In the latter part of August there was an active recurrence and Dr. Glass considered the case as practically hopeless, but advised a trial with the mixed toxins of erysipelas and bacillus prodigiosus, and referred the patient to Dr. H. H. Williams, of Mohawk, N. Y., who used the preparation of Coley's toxins. The injections were started on September 1, 1914, the initial dose being $\frac{1}{8}$ min.; they were given daily during the month of September; the first severe reaction occurred after a dose of 2 min., the temperature rising to 102° - 103° . No reaction was obtained after that until $4\frac{1}{2}$ min. were reached. Seven severe reactions in all were obtained during the entire course of treatment, all injections being given systemically. The patient had daily treatments during September; 15 in October; 8 in November; 4 in December; 3 in January; 1 in February, and 1 in March. All evidence of the tumor disappeared in December, and the patient has been in good health up to the present time.

Physical examination at time of presentation (March 24, 1915) shows absence of most of the left superior maxilla over to the malar bone; floor of orbit absent. There is absolutely nothing abnormal either in the interior of the mouth or externally. The left malar bone is normal in size and appearance; her general health is good.

INOPERABLE RECURRENT MALIGNANT TUMOR OF NASOPHARYNX INVOLVING ETHMOID, SPHENOID, FRONTAL AND SUPERIOR MAXILLÆ BONES (CARCINOMA): DISAPPEARANCE UNDER SIX WEEKS' TREATMENT WITH THE MIXED TOXINS.

DR. WILLIAM B. COLEY presented a man, thirty-eight years of age, who, in August, 1914, first noticed difficulty in breathing through the nose. Shortly afterward he consulted a physician, who found a tumor blocking up both nostrils and extending into the nasopharynx. A portion was removed and sent to Louisville, Ky., for microscopical examination; negative report was received. The tumor grew with great rapidity,

and in the next two months two operations were performed, both incomplete. At the last operation, the tumor was found to extend into the frontal sinuses and involve the ethmoid and sphenoid bones. On December 28 he consulted Dr. J. M. Ray, of Louisville, Ky., one of the leading throat and nose specialists of the South, who gave an absolutely hopeless prognosis, and said that nothing further could be done. Finally, on January 24, 1915, he consulted Dr. John B. Murphy, of Chicago, who considered the condition entirely inoperable and referred him to Dr. Coley for toxin treatment.

The portions of tumor removed at the first and second operations were not kept, and the patient positively refused to permit Dr. Coley to remove any further specimens.

He was admitted to the General Memorial Hospital on January 27, 1915. Physical examination at this time showed the patient very weak and anæmic, unable to walk without support. He had severe pain in the head, especially marked in the frontal region, requiring $\frac{1}{4}$ grain doses of morphine. The whole contour of the forehead and upper portion of face and nose was markedly distorted. There was a tumor involving both nasal cavities, both superior maxillæ, ethmoid and sphenoid bones, producing a pronounced broadening of the nose, particularly marked at the bridge of the nose, which was 2 inches in width, and bulging of the whole frontal region. The right malar bone was much more pronounced than the left, but both were enlarged. There was also marked exophthalmus of the right eye, with dislocation outward for one inch or more, causing inability to focus; he had not been able to read for more than a month. The tumor extended down as far as the upper lip. The patient had a complete congenital cleft palate. The superior maxillæ had been separated by the tumor, causing a space one inch wide in the centre, where one of the incisor teeth had been drawn. Through the cleft in the soft palate a large fungating tumor could be seen, occupying the whole space between the soft palate and the pharynx. This tumor bled very easily, the patient losing more than one-half pint of blood on some days. He had lost twenty-four pounds since August. The disease was so very extensive and the general condition of the patient so bad Dr. Coley at first declined to treat him, believing the condition hopeless. He finally consented to try the toxins at the urgent request of his wife.

On January 27, 1915, the toxins were begun, the initial dose being $\frac{1}{2}$ min., which was injected into the pectoral region. The dose was increased by $\frac{1}{2}$ min. each day. On January 29, there was a slight bleeding from the tumor behind the palate. The hemorrhages increased and, on

INOPERABLE RECURRENT MALIGNANT TUMOR

February 3, he lost 5 oz. of blood in the morning and 2 oz. in the evening. On February 5, there was considerable bleeding which was only partly controlled by spraying with adrenalin and packing. On February 6, 10 c.c. of horse serum were given subcutaneously, after which the hemorrhages temporarily became much less until, on February 11, he lost 6 oz. of blood in the morning and 4 oz. later in the day. Another dose of 10 c.c. of horse serum was administered. On February 12 he lost 12 oz. of blood, and on February 13 he lost 5 oz. at one time and 2 oz. at another. The bleeding continued at intervals of 20-30 minutes during the day. On February 14, there was a slight bleeding from the mouth. By this time the dose of toxins had reached 6 min., causing a slight temperature of 99, but no chill. After the first week, the dose was increased by 1 min. per day, and, on February 16, with a dose of 7 min. the first chill occurred, which lasted for twenty minutes, followed by a temperature of 101°. From this time on he had no further hemorrhages. The pronounced local and general improvement which had been noticeable at the end of one week's treatment continued. There was marked diminution in the size of the external tumors, as well as decrease in the size of the tumor in the nasopharynx. Eight minims given on February 19 produced no chill, nor did the next three doses of 9½ min. each, given on February 20, 21 and 23. On February 24, 9½ min. produced a chill. On February 26, 10 min.—no chill; on February 28, 10½ min.—no chill. On March 1 the same dose as on the preceding day, injected into the pectoral region, was followed by a very severe reaction; the patient had not entirely recovered from the depression of the preceding day. One hour after the injection he had a chill lasting 40 minutes; one hour after this, a second chill occurred, which lasted an hour; the temperature rose to 104° immediately after the first chill; one hour after the second chill it was 104.6°. The patient was in a state of collapse; instead of being cyanotic he became unusually red. The pulse went up to 136 and was very weak; respiration 32. He was not given any stimulants. Two hours after the second chill the temperature fell to 102° and the next morning both pulse and temperature had fallen to normal. The patient was very weak, but was up and about the room.

On March 3, two days later, a very remarkable change had occurred in the tumor as well as the contour of the face; the eyes were much closer together, nearly normal. The exophthalmus, which had become much diminished, had practically disappeared; the bulging in the frontal region had nearly subsided, and for the first time in three months the jaws came together in their normal position. The patient was then given

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a respite from treatment for 2-3 days, after which the injections were resumed in smaller doses, 5 min. He received 22 treatments in all while in the hospital. Hæmoglobin, which was 80 per cent. when he entered, fell to 68 per cent. by the time of his discharge. The improvement continued; he gained in weight at the rate of nearly a pound a day. On the day of his discharge from the hospital, March 9, the following note was made by the resident surgeon, Dr. Dempsey:

Patient discharged March 9. The swelling of the bridge of his nose, between the eyes, has entirely disappeared; the eyes appear to be in a normal position; the cleft in the palate is much narrower; there is now only room for one tooth in the gap of the upper jaw (on entering the hospital this gap was one inch wide); through the opening in the palate only smooth, clean tissue can be seen; there is no evidence of any tumor; the patient's teeth now meet properly, for the first time since months. Except for a little thickness over the nose the subjective symptoms have entirely disappeared. The patient has gained markedly in weight and strength.

For the last two weeks he has been able to breathe through one nostril, and for the last week through both, for the first time since August 15, 1914. He had three X-ray treatments in the early part of February.

Three X-ray plates were taken, the first one, soon after the toxin treatment was begun, showed only a general confused blurring of the whole plate, the outlines of the different bones completely lost.

The second X-ray was taken on February 22, and showed extensive destruction of the bones of the superior maxilla, tubinates, ethmoids, vomer, etc., extending to the sphenoid sinus.

The last X-ray, taken on March 18 by Dr. Holding, showed remarkable changes, the several bones had nearly recovered their normal outline. He has had toxins in small doses, 3-4 min. daily since he left the hospital, and has gained 14 pounds in weight. The contour of his face and nose is entirely normal, and no trace of tumor can be found.

Later History.—Shortly after the patient was shown before the N. Y. Surgical Society, Dr. Coley succeeded in securing from Dr. Hays in Louisville a slide of the original specimen removed for examination in August, 1914, which had been pronounced negative. This slide was submitted to Dr. James Ewing who reported as follows:

(April 21, 1915.) The material received consists of stained sections of two small portions of the nasal mucose invaded by the tumor. The tissue is not sufficiently well fixed or stained to permit of a fully satisfactory study, but it is clear that the tissue is the seat of a malignant tumor process.

The tissue is cedematous and inflamed and infiltrated with groups of tumor



FIG. 3.—February 12, 1915.



FIG. 4.—February 12, 1915, side view.



FIG. 5.—March 18, 1915.



FIG. 6.—March 18, 1915.

Cancer of nasopharynx disappearing under treatment with the mixed toxins (Coley).



FIG. 7.—February 12, 1915.



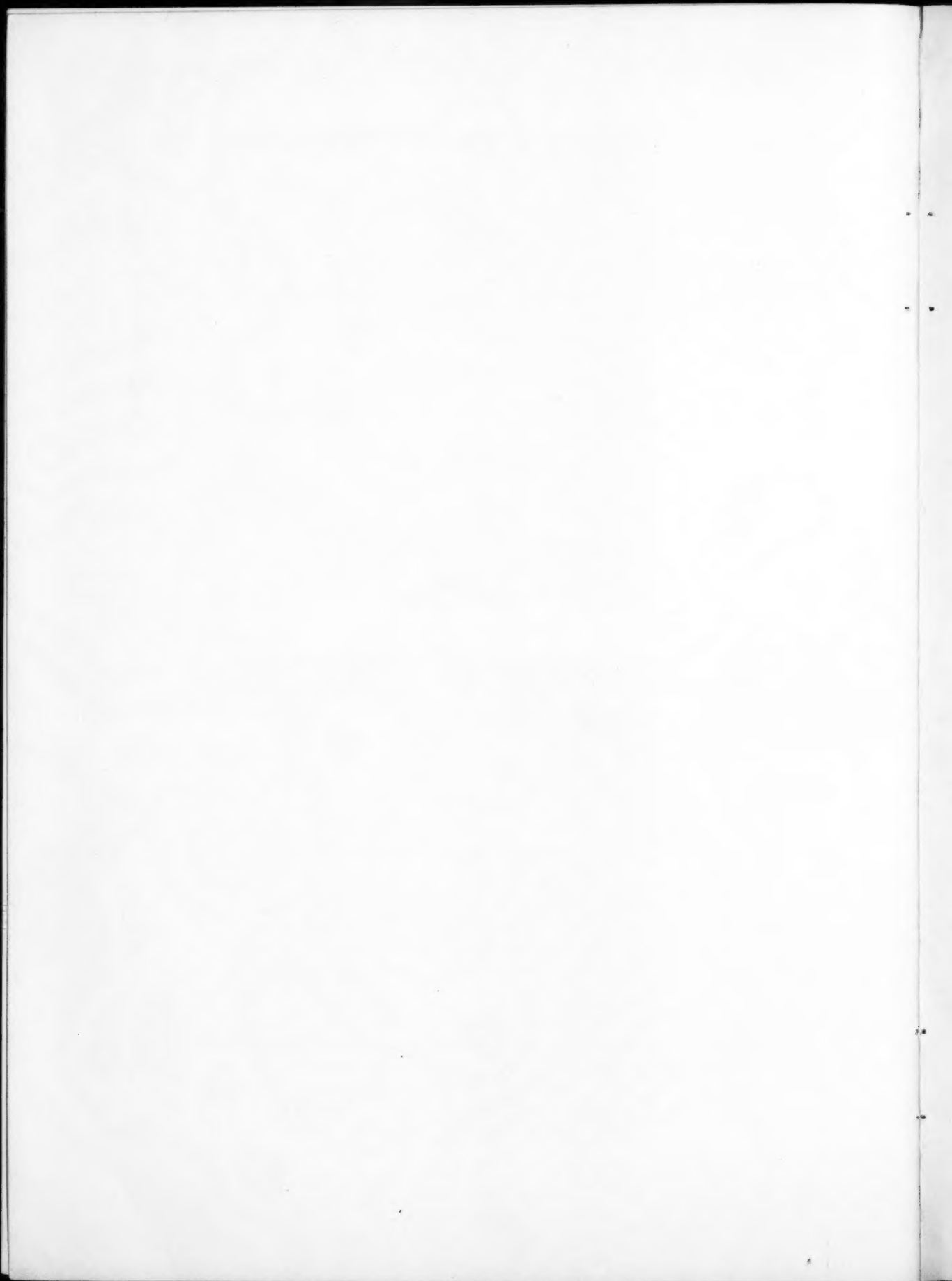
FIG. 8.—March 20, 1915.



FIG. 9.—February 12, 1915.



FIG. 10.—March 20, 1915.



INOPERABLE RECURRENT MALIGNANT TUMOR

cells. The cells are polyhedral or compressed into various elongated or irregular shapes. The nuclei are large homogeneous and hyperchromatic. No nucleoli are visible. The cells are arranged in large compact groups in which there is no stoma, or in small clusters separated by thin strands of connective. The cell groups are widely scattered in the œdematous tissue. The overlying epithelium of the mucosa is intact but exfoliating.

The exact nature of the tumor it is impossible to state, but the general appearances are those of a carcinoma with poorly differentiated epithelial cells. An origin from the lining cells of the mucosa seems probable. Of the malignant characters of the process there can be no doubt. (Signed) J. Ewing.

April 15, 1915, Dr. Coley received from Dr. Ray, of Louisville, the following letter:

I have intended for several days to write you and congratulate you on the result in the case of Mr. R., who was sent to you by Dr. Murphy. I saw Mr. R. the last week in December, he having been brought to me by his local doctor. I found the following:

He had a congenital cleft palate. Apparently springing from the nasopharyngeal space to which it was firmly attached, was a mass that protruded forward filling both nostrils and invading the orbits, separating the superior maxillæ along their median attachment, almost protruding from the nostril in front and bleeding profusely when lightly touched. As I have seen a number of cases of so-called recurring fibroma in the nasopharynx and as several attempts had been made to remove this, I considered it a recurring fibrosarcoma starting in the nose and nasopharynx, which growths are more or less familiar to nose and throat men. Although I did not have the tissue examined, largely because of the man's physical condition, which appeared to me to be hopeless, it certainly was not an operable case as no form of surgery could have completely eradicated the growth with any hope of success. He dropped in to see me while passing through the city on his way home, ten days or more ago. I wish to bear witness to the wonderful result. (Signed) J. M. Ray.

On March 25, the patient returned to his home in Kentucky and continued to take the toxins in small doses, 2-3 minims twice or three times a week, which failed to produce any reaction. At the end of three weeks he wrote Dr. Coley that he had noticed a small lump just behind the angle of the jaw on the right side of the neck; he also had a slight return of the headaches, and gradually increasing obstruction in breathing through the nose. Dr. Coley urged him to return at once, but he was unable to do so until April 26, when he was readmitted to the General Memorial Hospital.

Physical examination at that time showed a smooth globular swelling, the size of an English walnut, situated just behind the angle of the jaw, on the right side of the neck and underneath the anterior border of the sternomastoid muscle. Tumor freely movable and of

the consistence of a round-celled sarcoma. A slightly smaller mass was present on the left cervical region. The right eye showed a slight return of the exophthalmus, and the upper jaw at the line of the teeth again showed nearly an inch in separation. He had again begun to lose in weight. There was no increase in the width of the bridge of the nose and no return of the fulness in the frontal region; slight return of the tumor in the cleft behind the soft palate. No air could be forced through either nostril.

He was immediately put upon the toxins, beginning with $4\frac{1}{2}$ minims, and increased by 1-2 minims each day. He proved to be much less susceptible than during the former period of treatment, and did not get any chill until a dose of 25 minims had been reached. He continued to lose in weight, and the headaches remained about the same, until the dose had been increased up to the point of producing a severe reaction, when he again showed very remarkable improvement, the headaches disappeared and he gained two pounds in weight in 3 days. During the third week in June he had two severe chills.

July 1, 1915, his condition is as follows: Appetite has returned; the separation in the jaw is narrowing (it is only $\frac{3}{8}$ inch now) and the gland underneath the angle of the jaw is not more than one-fourth the size it was on April 26. He is receiving five injections a week and is now taking 27 minims of the toxins.

He had three X-ray treatments during his second stay in the hospital.

August 3, 1915, examination to-day shows no trace of tumor. The exophthalmos has entirely disappeared as well as the enlarged glands on both sides of the neck. The separation in superior maxillæ has reduced to normal and he breathes freely through both nostrils. He has regained most of his lost weight and feels as well as usual. During July the toxins were given three to four times a week, the largest dose being 32 minims. He was discharged from the hospital July 31, 1915.

This case is especially noteworthy and instructive for the following reasons:

1. After a very far advanced and inoperable malignant tumor had apparently disappeared under toxin treatment, a quick recurrence followed a reduction in the size of the dose from ten minims to two or three minims.
2. The recurrent tumors, both primary and metastatic, grew rapidly and showed no signs of control until the dose of toxins had been increased to more than double the amount tolerated during the first period of treatment.
3. Under these large doses and severe reactions all evidence of

LYMPHANGIOPLASTIC FOR ELEPHANTIASIS

both primary and metastatic tumors again disappeared, and the patient's general health was restored.

This case would seem to confirm the opinion previously expressed by Dr. Coley, that the success or failure in a given case depends largely upon (1) the proper, but often very difficult adaptation of the dose of toxins to such cases and (2) continuation of the treatment for a long period.

Stated Meeting, held April 14, 1915

The President, DR. FREDERIC KAMMERER, in the Chair

LYMPHANGIOPLASTIC FOR ELEPHANTIASIS

DR. ALEXIS V. MOSCHCOWITZ presented a patient fifty-seven years of age, who was admitted to Mount Sinai Hospital January 13, 1915, with the following history: Patient had had typhoid fever thirteen years ago, which lasted three months. During his convalescence, he noticed a swelling of both legs (presumably phlebitis). After his discharge from the hospital he was able to resume his work, but gradually he became more and more incapacitated. Eight years later, he again entered a hospital and was operated upon; the operation consisted of a circular incision in the upper part of the right calf. Not only did no improvement follow this operation but, as may have been expected, the operated leg became materially and progressively worse.

When admitted to Mount Sinai Hospital the right leg presented a grotesque appearance. It was of a uniformly dark brown, mahogany color, covered with crusts and scales. The skin was greatly thickened, and was elevated in massive folds. After cleansing, innumerable veins were seen coursing throughout its texture. A similar condition, only less marked, existed in the left leg. (As the condition of the skin was such as to preclude the possibility of obtaining an operative sterility, the patient was temporarily transferred to the dermatological service of Dr. Goldenberg, where he was treated with various emollient ointments and elevation of the extremities.) By February 10, the condition of the skin became such that the patient could be safely operated upon. It was evident that the patient was suffering from a lymphstasis induced by the original phlebitis and made worse by the circular incision. (The various procedures possible in this condition were carefully considered, namely, excision of blocks of skin (Kusnezow); the re-establishment of the lymphatic circulation (Handley); the deviation of the lymph from the superficial to the deep lymphatics (Kondoleon-Rosanow). The last mentioned was finally decided upon as being the least risky and the one promising the greatest amount of success.)

The operation was performed in the following modified form. Four longitudinal incisions were made on the outer and inner aspects of the leg respectively. The skin was dissected back and a large quadrilateral flap was elevated, consisting of either the fascia lata or deep fascia, so that it was free on three sides, and still attached on the fourth side. A deep groove was now made in either an intermuscular septum or through the muscle itself and down to the bone, into which the fascial flap was fastened by catgut sutures. The defect in the fascia was then closed, and over that the skin was united. Primary union followed, except at the intersection of the old circular incision, and the patient was discharged seventeen days later.

Even in the short time that has elapsed since the operation there has been considerable improvement, and in view of this fact it is quite possible that the improvement will continue. The patient will be kept under observation in order to learn the late result of the operation in these otherwise hopeless cases.

EXCLUSION OF COLON WITH UNUSUAL COMPLICATIONS

DR. MOSCHCOWITZ presented a patient, sixty-one years of age, who had been operated upon at the Har Moriah Hospital in February, 1914, for a carcinoma of the sigmoid flexure. It was his intention at the time to excise the tumor, to close both ends, and reestablish the continuity of the gut by a side-to-side anastomosis. Just when both ends of the gut were securely closed, and he was about to make the anastomosis, the anesthetist stated that the condition of the patient was such as to indicate haste in discontinuing the operation. It would have been easy to have established an artificial anus, but the patient was averse to such a procedure and besides it was thought there would be no difficulty in persuading him to whatever secondary operations might become indicated. The operation was therefore hurriedly finished in the following manner. An anastomosis was made between the ileum and the lowermost part of the sigmoid flexure, with a Murphy button; as this, however, would have excluded distally practically the entire colon, a safety valve for it was made in the form of an appendicostomy, through a McBurney incision on the right side. The condition at the termination of this operation is illustrated in Fig. 1.

The patient developed a bilateral lobar pneumonia, which rendered the post-operative course exceedingly stormy, but finally he was discharged in excellent condition. No amount of persuasion could induce him to submit to any further operation.

For several months there were no untoward symptoms on the part

EXCLUSION OF COLON

of the unilaterally excluded colon. In spite of warnings, the patient withdrew the small drainage tube from the appendicostomy wound. This gradually contracted, and then trouble began. The patient complained of cramp-like pains and distention of the abdomen. When the abdomen became distended to a maximum, there were also intestinal erections, and amidst violent pains the patient would suddenly pass a large amount of very foul smelling flatus, followed by a collapse of the abdomen. These were evidently retroperistaltic evacuations of the colon through the ileosigmoidostomy. On an average, there were four liquid stools a day. The patient's condition became progressively worse, and finally he was persuaded to enter Mount Sinai Hospital, where he was admitted October 26, 1914.

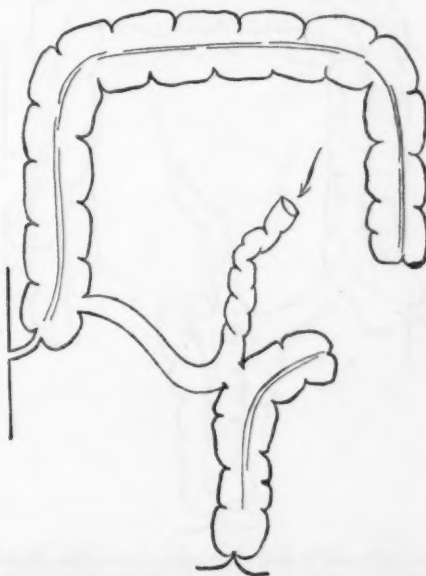


FIG. 1.—Diagrammatic presentation of case after first operation, showing the ileosigmoidostomy and appendicostomy.

The physical examination revealed a well-healed median abdominal scar; a scar with considerable herniation in the right lower quadrant of the abdomen, in the centre of which there was a tiny fistula which discharged a droplet of mucoid pus, and which could not be probed into the depth. There was some doubt as to the indicated procedure, and finally the following plan was decided upon:

Operation (October 28, 1914).—Colostomy in the descending colon through a Kammerer incision. No metastasis was found on exploration. The colon was enormously hypertrophied and dilated; a single

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loop of small intestine was adherent to its occluded end. A small area of the colon was sutured into the wound, and was opened three days later, giving vent to a large amount of gas and brownish fluid.

Between October 28 and October 31, the bowels did not move at all. Thereafter, they moved on rare occasions per rectum, but most of the time very freely through the left-sided colostomy. The condition of the patient at this stage is illustrated in Fig. 2.

November 18, 1914, third operation. Entrance through the McBurney scar upon the right side of the abdomen. First, the appendix was extirpated in the usual manner; then the ileocaecal valve was

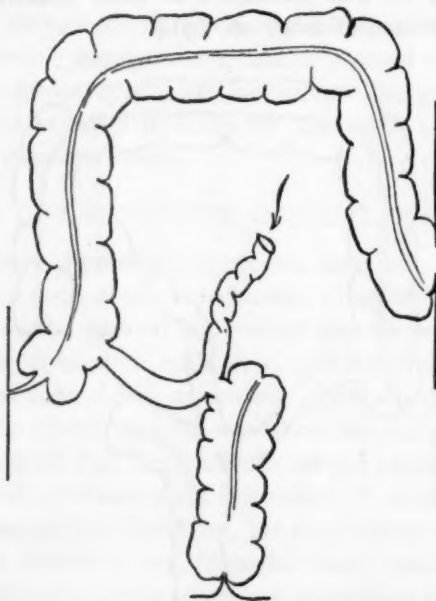


FIG. 2.—Diagrammatic presentation of case after second operation, showing ileosigmoidostomy, appendicostomy, and colostomy in descending colon.

exposed and the ileum traced back to its junction with the sigmoid, about eight inches. The ileum was then divided, both ends closed by suture, and dropped back. The McBurney incision was repaired in layers. The condition of the patient at this stage is illustrated in Fig. 3.

After this operation, the patient was most uncomfortable, being considerably distressed by obstinate hiccough and vomiting. A rectal tube was passed on November 20, and about fourteen ounces of a bloody fluid, mixed with faeces, were withdrawn. This showed that at that time the original stoma was apparently still intact. Thereafter, all attempts to move the bowels, by frequent and repeated enemata,

EXCLUSION OF COLON

and by various cathartics, were ineffectual. In spite of the discomforts, however, the general condition of the patient did not deteriorate rapidly, and it was deemed justifiable to wait further developments.

On November 26, a futile attempt was made to expose the ileosigmoid anastomosis with the sigmoidoscope. On November 30, a second attempt was made by the adjunct surgeon, Dr. Wilensky: "The sigmoidoscope was passed; high up on the side, an opening was seen; an attempt to enter this with the sigmoidoscope was successful; apparently mucosa of a different nature was seen, and then the instrument was withdrawn." Eight hours later, after an ineffectual enema, the patient had four stools; on the following two days there was diarrhoea;

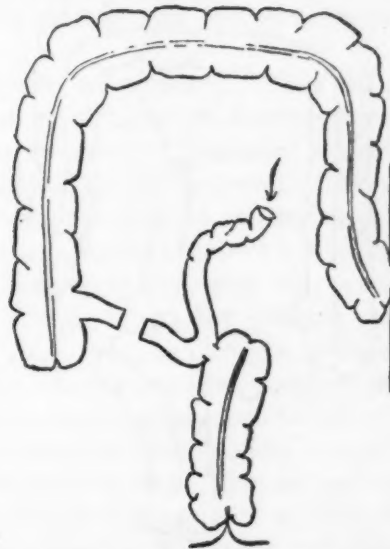


FIG. 3.—Diagrammatic presentation of case after third operation, showing ileosigmoidostomy, extirpation of appendix, and occlusion of ileum.

thereafter, one or two movements daily, and the patient was discharged at his request on December 8.

He was readmitted December 15. Following his discharge he was well for four days; then, after an indiscretion in diet, he again became obstinately constipated, accompanied by hiccough, vomiting, and distention of the lower and central part of the abdomen. However, within twelve hours after his admission, a liberal evacuation was obtained with the aid of castor oil and enemata. But again absolute constipation followed. His general condition was so wretched that, though at first Dr. Moschowitz was greatly disinclined to operate, he finally consented to do so when the patient was almost moribund.

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December 22, 1914, the median incision was reopened. The small intestines were found to be injected and enormously distended. The location of the obstruction was traced downward, and was found to be at the site of the old ileosigmoidostomy. The anastomosis was so constricted that its lumen was apparently obliterated. Rapidly a second anastomosis was made with a Murphy button, between the ileum and the upper part of the rectum. Immediately upon closing the button and removing the proximal occluding clamp, a quantity of flatus and fæces was expelled through a tube passed into the rectum, followed by collapse of the small intestine. The final and present condition is illustrated in Fig. 4.

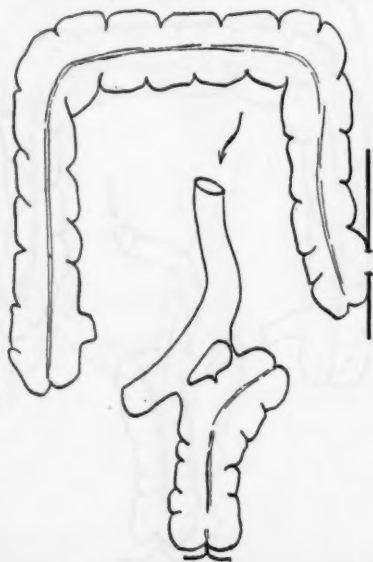


FIG. 4.—Diagrammatic presentation of case after fourth operation, showing, in addition to Fig. 3, the closure of the original ileosigmoidostomy and reestablishment of ileoproctostomy.

There was a slight superficial infection of the abdominal incision which, as well as a complicating nephritis, protracted the patient's stay at the hospital, so that his final discharge did not take place until February 13, 1915.

The case presents several unusual features, but the most interesting one was the rapid contraction, if not closure, of the ileosigmoid stoma, after the establishment of a distal colostomy.

ILEOFEMORAL ANEURISM

DR. JAMES M. HITZROT presented a man, aged thirty-five years, who was admitted to the First Surgical (Cornell) Division of the New York

ILEOFEMORAL ANEURISM

Hospital on February 11, 1915, complaining of a swelling in the left groin, and pain in the left knee and hip. Three months before admission the patient began to have a dull aching pain in the left groin and in the left hip and the left knee. Two months before admission, he noticed a swelling in the left groin which increased slowly in size but was not tender to the touch. With the appearance of the swelling the pain in the knee and hip became worse, noticeably so after walking and at night. Within the two months mentioned he has been unable to stand perfectly erect, and has found the most comfort when he keeps the thigh and the knee slightly flexed.

His past history is negative except for a soft chancre accompanied by a bubo in the left groin. No history of secondary luetic symptoms was obtainable. He has had four Neisser infections in the last eight years.

Examination showed in Scarpa's triangle of the left thigh, extending from Poupart's ligament about 10 cm. down the leg and from the region of the anterior superior spine to the internal aspect of the leg, an ovoid swelling with a distinct, visible pulsation. The skin over the mass is slightly ecchymotic, especially so on the outer aspect of Scarpa's space. The mass is firm, elastic, and there is a definite expansible pulsation, and a palpable thrill synchronous with the heart beat. Owing to the size of the swelling it was impossible to compress the femoral artery against the pubic brim, as the mass seemingly extended above Poupart's ligament. There was a loud, rough systolic murmur audible over the entire mass. No pulsation could be felt in the popliteal space, or in the posterior tibial or dorsalis pedis artery, while there was a distinct pulsation in these vessels in the other leg. Over both lower legs there were pigmented scars suggestive of an old luetic process.

The Wassermann reaction was taken and reported as four plus. The patient was then put on anti-luetic treatment and given mercury hypodermically, and three injections of salvarsan intravenously. Following the injection of the salvarsan the pain in the aneurism was markedly decreased.

On February 22, 1915, a rapid increase in the size of the aneurism occurred which continued up to the date of his operation. On February 26, 1915, under gas and ether anæsthesia, a five-inch incision was made to the left of the median line, and the rectus muscle was drawn out. The intestines were walled off with gauze and the external iliac artery exposed about 5 to 6 cm. from Poupart's ligament. The aneurismal dilation projected through the femoral ring, at which point perfectly definite expansible pulsation could be felt. After freeing the artery,

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a double fold of chromicized pig's bladder was passed around the artery so that it made a loop about the artery wall. The loop was drawn taut so that the pulsation in the sac completely disappeared, but was so regulated that the artery distal to the constricting ligature could be felt to pulsate quite distinctly, although the volume of this pulsation on the proximal side was less than one-fifth that in the artery above the constricting band.

In order that a broad constricting band should be present, a second loop similar to the first was passed about the artery just above the first mentioned ligature and fastened so that it did not interfere with the pulsation above described. The chromicized bladder strip in each case was fastened by one friction knot, and the free ends were then fastened to the subperitoneal tissues by a number of chromicized catgut sutures passed through the pig's bladder and through the fascia. The peritoneum was then closed over the ligature with plain catgut. The abdomen was closed in layers, using silkworm-gut and figure-eight stitches. At the close of the operation there was no pulsation felt in the aneurismal sac.

The patient's convalescence was uninterrupted and pulsation in the aneurismal sac was absent until April 10, when a return of the pulsation was noticed, which has gradually increased to the slightly expansible pulsation which now exists in the tumor mass.

Partial proximal occlusion of the artery in the treatment of aneurism was recommended by Porta in 1850, and subsequently Nazzetti used a fascial flap, Halstead an aluminum band and later a strip of aorta, and Matas and Allen aluminum bands for the purpose of partially occluding the vessel entering the aneurismal sac.

In this particular instance it seemed to the reporter that the chromicized pig's bladder, which can be readily obtained, would fulfil all the indications in the case, and that partial occlusion by means of the pig's bladder could be used as a preliminary step to a subsequent Matas operation, inasmuch as the Matas operation at the first sitting in an actively luetic blood-vessel seemed unlikely to succeed, and because of the possibility of an insufficient collateral circulation to maintain the nutrition of the leg. It is possible that the present pulsation is due to either the establishment of this collateral circulation, or possibly to the return of the full force of the blood stream along the course of the artery due to the absorption of the pig's bladder.

On April 5, 1915, an aspirating needle was passed from the outer aspect of the sac for about four inches into the sac itself. There was a very thick quite tough sac wall, and only semifluid, chocolate-colored

LYMPHOSARCOMA OF THE JEJUNUM

blood was obtainable, an indication that at that time, that portion of the sac wall which the needle entered had no arterial blood in it.

LYMPHOSARCOMA OF THE JEJUNUM

DR. HITZROT presented a man aged thirty-five years, who was admitted to the First Medical (Cornell) Division of the New York Hospital, March 3, 1915, with the history that six months before admission he began to suffer from pain in the epigastrium, which pain has been almost constant since that time. The pain is present before meals, is worse after eating and this increase in pain lasts for several hours. The pain after eating is accompanied by nausea, but he has not vomited. During the last three months, the pain has become more aggravating. He has been persistently constipated. He has no cough. He has had occasional night sweats. One year ago his weight was 150 pounds, now he weighs 118. His physical examination was negative except for the scars of an old burn over his chest and some epigastric tenderness. At different times a mass could be felt to the left of the median line, which was tender and freely movable.

Numerous test meals were made which showed a constant absence of free hydrochloric acid and a total acidity of 10, with a positive guaiac test. There was no gastric retention. The X-ray pictures were negative, except for a certain amount of irregularity about the pyloric antrum without any pyloric obstruction or gastric retention, and nothing abnormal was visible in the small gut. His Wassermann was negative, and the blood and urine showed nothing abnormal.

March 19, 1915, he was transferred to the First Surgical (Cornell) Division at the Hospital, and an exploratory laparotomy was done on March 20 under gas and ether anaesthesia through a four-inch incision in the epigastrium just to the right of the median line. On opening the abdomen peritoneal surfaces were found perfectly normal. The stomach was explored and both by inspection and palpation was entirely normal throughout. The gall-bladder was normal. There were three tumor masses found in the upper portion of the small intestines, occurring in that portion of the jejunum about 20 inches from the ligament of Treitz. There were no other masses at any point in the small intestines.

Resection of the tumor-bearing mass with its mesentery was quite readily effected by catching, distal to the tumor, the intestine between two rubber covered clamps, and dividing the intestine so as to leave a free margin at the lower end. In order to go wide of the tumor at the upper portion, it was necessary to strip back the peritoneum and expose the last portion of the duodenum. This was then done and

the duodenum clamped off, a sufficiently free margin being left for the suture, to be spoken of later. The divided segment of the intestine was then removed, the mesenteric vessels being caught by transfixion stitches as they were exposed, and a large wedge of the mesentery was removed, care being taken to remove with it the glands clear back to its attachment. The divided intestinal ends were then approximated and an end-to-end anastomosis done by the Connell method, using interrupted silk stitches for the first layer. This was further reinforced by another layer of silk stitches, and a continuous chromic catgut stitch over at least two-thirds of the circumference of the intestines. The mesentery was approximated by a few interrupted plain catgut stitches. A small rubber drain was passed to the site of the anastomosis and the peritoneum, which had been reflected, was resutured over the duodenum and over the site of the anastomosis. The wound was closed in layers using catgut, figure-eight silkworm stitches with interrupted horse-hair stitches in the skin. His convalescence was uninterrupted and, on April 4, he was sent to the country much improved, with no pain after eating, as had existed before the operation.

Lymphosarcoma of the intestine is a relatively rare condition. Libman (*Mit. aus Grenz. d. Med. u. Chir.*, vii, 4, 5) collected 42 cases, 15 involving the duodenum, 18 the jejunum and ileum, 14 the ileum, and 3 the entire intestinal tract; and of these, the lymphosarcomata were the most common type.

DR. ARPAD G. GERSTER reminded the older members of the Surgical Society that he had presented two cases before the Society, one of them many years ago. In that one he had shown a specimen of the intestine of the patient who had had a prolonged hemorrhage. When first seen the man was moribund, and nothing could be done for him. At the autopsy examination a sarcoma was found occupying the lower portion of the duodenum, about as large as a small Spanish olive. This sarcoma was the source of the hemorrhage which had filled the entire small intestine. Preceding the last hemorrhage, the patient had had a number of smaller ones, but no diagnosis had been made for the disease was very insidious.

The second case was presented four or five years ago. The patient had an incarcerated hernia of the right side, which was relieved by a radical operation. When he recovered from that he complained that the pains he had had in his belly from time to time had not been relieved, and that he still suffered from them. Some months later, he came to the office, and examination revealed just such a condition as Dr. Hitzrot had described, a tumor which was slipping about in the abdomen

GUNSHOT WOUND OF THE ABDOMEN

and could be felt first in one place and then in another, as far distant as the right hypochondrium and the left inguinal region. As the pains were occurring frequently, it was thought that the tumor might be a gall-stone. No diagnosis of sarcoma was made, as the symptoms were those of sudden colic, without constipation or vomiting. The patient was admitted to the hospital; an incision was made in the median line, and a small tumor the size of a hen-egg was found occupying the jejunum, seven or eight inches below the ligament of Treitz. It had caused an intussusception involving 5 or 6 inches of the gut. The intestine was resected and removed, and the patient made a good recovery, and is still alive. The pathological diagnosis was lymphosarcoma.

GUNSHOT WOUND OF THE ABDOMEN

DR. HITZROT presented an adult male, who was admitted to the First Surgical (Cornell) Division of the New York Hospital, April 1, 1915, with the history that he had been shot in the abdomen one hour before admission by a revolver in the hands of an unknown man. He was in considerable shock. There was a bullet wound about one inch above the navel and three inches from the median line. No point of exit could be found. The abdomen was scaphoid, board-like, with signs of fluid in the left flank. There was bright red blood in the urine.

Under gas and ether anæsthesia an immediate laparotomy was done, and the bullet was found to have penetrated the omentum and transverse mesocolon just above the transverse colon. It had then wounded the outer coat of the jejunum, and about 10 m. from the ligament of Treitz had passed completely through the intestine, leaving two wounds from which the mucosa projected, and through which the intestinal contents were being discharged into the mass of blood in the left gutter. The bullet then passed into the left kidney, completely shattering that organ at the hilum. The kidney was removed and its pedicle ligated. The wounds in the gut were closed with silk sutures. A rubber dam drain was passed into the kidney pouch and the wound rapidly closed. The bullet could be felt in the muscles of the back by a finger passed through the wound between the eleventh and twelfth ribs, but could not be grasped by any forceps then available, and was left. The patient made an uninterrupted recovery.

Dr. Hitzrot showed the specimen of the kidney removed and an X-ray plate showing the present position of the bullet between the ribs.

DR. GERSTER said that he would like to add a few words based on a recent experience. When the late Dr. Bull first sewed up successfully a multiple gunshot wound of the small intestine, it was thought a

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wonderful thing that the patient survived. The first man in America who sewed up successfully a gunshot wound of the intestine was Kinloch, of Charleston, S. C., in the Civil War. Since then, this material has increased enormously, and it is known that if it is done before peritonitis has set in, or before extensive loss of blood has taken place, recovery may occur in a large proportion of cases, even though the patient has very extensive and multiple injuries.

There is an enormous difference between this form of traumatism and that from blunt, crushing injuries, to which the intestine is exposed, such as occur in being run over by a truck or automobile. The shock in the latter case is much more pronounced and the patient's life is often compromised, even when surgical repair is skilful and prompt. Very often the patients do not recover from the shock, and die in spite of everything that may be done for them.

ADENOCARCINOMA OF THE RECTUM

DR. PARKER SYMS presented a man, aged sixty-three years, who when first seen by Doctor Syms, April 27, 1912, had shown symptoms a very short time. A few weeks before the date of examination he had been apparently well. He had not passed blood nor excessive mucus and had no signs of ulceration; in fact, his only symptoms were those of constipation due to the obstruction. He had lost some weight and was not feeling in full vigor.

Examination showed an encircling growth about three inches above the anus. It appeared to involve the whole rectal wall, but the rectum appeared to be movable—not attached to the prostate or bladder.

April 29, 1912, with the patient in the Trendelenburg position, the abdomen was opened on the left side. An examination for metastases was made with negative result. The sigmoid was mobilized, so that eventually fourteen inches of the gut were amputated. This extreme mobilization was made possible by making free incisions through the peritoneum on either side of the mesosigmoid. The dissection through the peritoneum was carried as far as the bifurcation of the iliac vessels and the fat and lymphatics were removed as far as that point. After the gut had been thus mobilized, the continuity of the peritoneum was restored by ample sutures, until finally the floor of the peritoneal cavity was completely closed. After the abdominal wound was sutured and dressed, the patient was placed in the lithotomy position, the anus was closed with a purse-string suture and the lower rectum was removed within the sphincters after the manner of Hochenegg. When this

ADENOCARCINOMA OF THE RECTUM

lower dissection had been carried up as far as this upper dissection had been carried down, the rectum and the sigmoid were pulled down through the sphincters and a stout ligature was applied well above the growth. The rectum was sutured to its new position, particular pains being taken to make a secure junction at the anal margin. The ligature was left in position until the operation was completed. The rectum was divided with a thermocautery.

The patient made a satisfactory recovery. He has fully regained his health and is to-day apparently perfectly well. A few days after the ligature was removed, there was some superficial sloughing of the mucosa, which extended up within the sphincters, but satisfactory healing took place.

At present the patient has what amounts to functional control. He uses a mild laxative, and continues to use an enema each morning. His control is such that he has no soiling and no trouble whatever. To obviate the tendency to constriction, the size of the anus is maintained by the employment of a soft rubber bougie.

Dr. Syms said that in his opinion in these cases complete amputation with establishment of a permanent colostomy, doing the amputation by the combined abdominal and lower routes, is undoubtedly the most radical and safe method of procedure. However, such a procedure as was employed in this case has sufficient advantages to tempt the patient to take the increased risk. Removing the mucosa within the sphincters, bringing the rectal stump down through the channel thus established, is sufficiently satisfactory and it is much safer than any attempt at resection with circular anastomosis.

DR. FREDERIC KAMMERER said that if the patient had no control over his sphincter and had to take an enema every day, an inguinal opening would seem to be preferable, as it caused less inconvenience to the patient.

Dr. Kammerer said that he himself had abandoned resection of the rectum. He thought it the surgeon's first duty, especially when the carcinoma is near the anal opening, to excise the growth and the tissue immediately around it in as thorough a manner as possible. He felt that this was not always done in the attempt to save the sphincters. In the cases where excision can be made of the entire lower end of the rectum, saving the sphincters, and the intestine pulled down and united to the anal orifice, very good results had been obtained by many surgeons. The speaker had not been very fortunate with this operation, owing to sloughing of the lower end of the bowel. When a resection of the rectum is done in continuity with end-to-end suture of the bowel,

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a constriction at the line of suture always develops, moderate in degree perhaps, but always present. It had seemed to him that recurrences occurred at this point rather frequently and he had himself obtained better permanent results by amputating the rectum and sacrificing the sphincter. He agreed with Dr. Syms that the safety of the operation is enhanced by establishing a preliminary inguinal anus.

CONSERVATIVE SURGERY IN THE TREATMENT OF MALIGNANT DISEASE OF THE VOCAL CORD

DR. GEORGE D. STEWART read a paper with the above title.

DR. FREDERIC KAMMERER said that he was inclined to think that members of the Society had more frequently practised total laryngectomy than the operation described by Dr. Stewart. He himself had had no experience with the latter. A point of interest was the subject of narcosis. In his last cases of laryngectomy he had employed intravenous ether anaesthesia with very good results. Several times the patient had been on the operating table about an hour and a half to two hours and as much as two quarts of the mixture of ether and saline solution had been infused into the veins, according to the method described by Kuemmel some years ago.

The development of granulation tissue at the upper angle of the tracheotomy incision, when the tube had to remain in the trachea for a longer period, was not an infrequent occurrence, and a very troublesome one occasionally. Among a large number of tracheotomies for diphtheria he had often experienced great trouble in the late removal of the canula, which frequently had to be replaced owing to threatened suffocation, either immediately after removal of the tube or at a later period, even when the wound had healed. These granulations also develop on the posterior wall of the trachea when undue pressure is exerted by a faulty tube.

DR. ARPAD G. GERSTER said that when surgical interference in malignant disease of the larynx was first done, one of the great difficulties that the surgeons had to contend with was that few of the laryngologists who first saw the patients were willing to make a positive and early diagnosis. As a rule it was seldom made before the external glands were involved and the intrinsic cancer had become extrinsic. As soon as the glands are involved, the operation becomes dangerous and difficult. The results are also much worse and more disheartening to the patients. In a number of the early successful cases the patients operated upon committed suicide as a result of depression and disap-

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pointment. Within the last fifteen years, however, especially since the advance in the diagnosis of syphilis and tuberculosis, the laryngologists have become more prompt in making a diagnosis. Strong suspicion of cancer justifies early interference, even where the specimen removed by the intralaryngeal method has not given positive evidence of carcinoma. After having excluded tuberculosis and syphilis, what else can we have but a neoplasm? He knew of laryngologists who had made the diagnosis of carcinoma without having secured direct evidence until after the operation. Because the diagnosis is now made so much earlier, the operations described by Dr. Stewart have become possible, and should be performed more frequently than has been the case in the past.

DR. C. G. COAKLEY said that the early diagnosis of epithelioma is not more generally made in laryngological work than in other departments of surgery. The laryngologist does not always see these patients very early. Only once in a while in his experience had he been able to diagnose a case fairly early. Probably most of the cases had existed six months or a year before a positive diagnosis of carcinoma of the larynx was made, and that is not a long time. In one instance the patient gave a history dating back a year before he was seen, and he lived three years after the diagnosis was made. He died from suffocation without a tracheotomy.

Most of these cases are rather slow in their progress in patients after fifty-five years of age. On the other hand, one occasionally sees epithelioma in patients thirty-five years of age and upwards; and these run a very rapid course, and unfortunately the operative results are not so good.

As suggested by Dr. Stewart, age is a very important factor in these cases. Most of the carcinomas that we see in the larynx are of the slow-growing type; especially is that true where the carcinoma begins, as it frequently does, on the vocal cords. There are two different types: the carcinoma which begins on the vocal cords, or those that begin above or below the vocal cords. The latter are more rapid in their growth and more fatal than those that begin on the cord itself.

One reason why the diagnosis of vocal cord cancer is not made earlier is that the only early symptom is interference with the voice. There is no pain and no difficulty in swallowing, simply a progressive hoarseness. The voice before and after the operation is practically the same. So long as the patients are only hoarse, but can make themselves understood, they let weeks and months pass without attention; and then when they consult a physician it is frequently the family physician who does not look after the throat, but gives a little spray treat-

ment, and it may be some months after that before a diagnosis is established.

The diagnosis of cancer can be, and is as readily made by the laryngologist as any other condition. There are few throats that are not sufficiently tolerant to allow an examination, and the laryngologist who finds a mass in the larynx and does not determine what it is, fails to do his duty by the patient. If the patient is hard to examine, the differentiation may be made by the aid of the Wassermann reaction or by sputum examination, etc., thus eliminating syphilis and tuberculosis. One should cocaineize the larynx and take out a specimen and have it examined, and if that is not conclusive a second examination should be made. The laryngologist cannot feel the masses or examine them closely; he can only look at them through the mirror, but if what is seen arouses suspicion, a piece should be removed and examined carefully.

In reference to the matter of swallowing following these operations: that is mainly a question of how much tissue is removed and where. If the epithelioma is limited to the cord proper and there is not much oedema in the arytenoid region, there is very little difficulty in swallowing. On the other hand, in the case of the patient who failed to appear to-night, the arytenoid on the right side was completely removed, and he has a marked contracture at the present time. He is wearing a tube, and had a great deal of difficulty in drinking—he had to drink uphill, which aided him in swallowing.

Following all these operations, granulations occur in the larynx which are exceedingly annoying, and until recently have given much trouble to laryngologists, who have to watch the case. The denuded interior of the larynx is very prone to granulations, and the patient realizes a sense of obstruction for two or three months. His sputum is blood-stained and he will be suspicious of a recurrence of the disease. The granulations move up and down with respiration in an annoying manner. The laryngologist also may become suspicious and fear that the surgeon did not remove all of the growth; finally he removes a piece of the granulation and finds that it is only granulation tissue, not a recurrence at all.

Recently it has been found that radium applied externally to the larynx will remove granulations in a week or two by causing a thrombosis of the blood-vessels in a very remarkable manner. It has been a very gratifying discovery, and that is evidently what happened to this patient when he went to Johns Hopkins. On account of the great difficulty he was having with this bloody expectoration, he went to

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Baltimore, and there, without making any histological examination, they applied big doses of radium, and in a short time he had as nice and smooth a trachea and larynx as any one could wish.

The manner of getting at these growths for diagnosis is perfectly simple. If the patient is intractable and cannot stand a mirror, one can administer chloroform and pass a laryngoscope, or employ suspension laryngoscopy. It is very seldom now that a patient is subjected to a thyrotomy without knowing what he is operated for.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting April 5, 1915

The President, DR. JOHN H. GIBBON, in the Chair

GYNÆCOMASTIA

DR. NATHANIEL GINSBURG presented a man, nineteen years of age, in whom for six months the left breast has slowly and steadily increased in size without evidence of pain, and at present presents the appearance of a young female breast about puberty or a little later (Fig. 1). There is prominence of the nipple and distinct mammary tissue hypertrophy, with an areola of pigmentation about the nipple which is more marked than present on the right side. There is no record of antecedent injury, unless his occupation (a shoemaker) has predisposed him to occupational traumatism to this region. The breast tumor is a diffuse, somewhat circumscribed, enlargement, corresponding anatomically to the normal young adult breast outlines. There is no fixation or retraction of the nipple. There is no mammary secretion and no enlargement of the axillary lymph-nodes. Dr. John Speese (ANNALS OF SURGERY, April, 1912) regards this type of benign tumor in the young male breast as an adenofibroma and I am in agreement with his views, believing this case will histologically conform to that type of tumor. I do not believe this case in its inception could have been termed "Adolescent Mastitis" unless this is synonymous with adenofibroma.

DR. JOHN H. GIBBON (Transactions of the Philadelphia Academy of Surgery, April, 1912) reported the case of a young man twenty-one years of age, also a shoemaker, upon whom he had operated; and examination of whose tumor showed it to be an adenofibroma of the breast.

This is an unusual and rare breast tumor in the male, and since it is steadily increasing in size, with a view of removing the malignant potentiality present, I have advised and shall perform a plastic resection with preservation of the nipple.

Note.—Plastic resection of the breast and histological examination showed the breast enlargement to be a case of gynæcomastia.

DR. PENN G. SKILLERN, JR., disagreed with Dr. Ginsburg in his diagnosis of neoplasm, and regarded it as a case of unilateral gynæco-

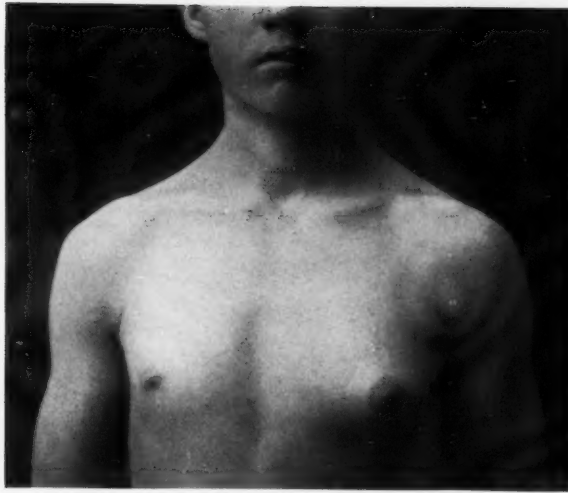


FIG. 1.—Hypertrophy of breast in a young adult male.



LOCAL DIPHTHEROID WOUND INFECTION

mastia, or physiological metamorphosis of the male breast into the female type, of which there are now about one hundred and ten cases on record. In support of this view, he related the history of the following case, which was seen by him in the Surgical Out-patient Department of the University Hospital (Case-record 39964), March 4, 1914, and reported, together with a photograph, in *International Clinics*, 1914, 24th series, vol. ii, p. 238.

A white male, aged nineteen years, single, student, stated that for the past two years he has noticed a gradual enlargement of the left breast, and that as the result of conversation with some medical students he feared he was getting a cancer. Examination revealed no neoplasm, but a well-developed left breast, corresponding to that of a sixteen-year-old girl. The right breast, the genitalia, and the sexual instincts were wholly masculine. Chiefly for cosmetic reasons, but also to anticipate the malignant degenerations to which anomalous structures are notoriously liable, a plastic operation was performed a year later.

Gynæcomastia may be bilateral or unilateral, and when one breast alone is involved, it is more often the left. Many cases are associated with anomalies of other portions of the reproductive apparatus, such as hypospadias, absence of pubic hair, etc. At times there is a familial predisposition. It might be expected that such an anomaly would show degenerative changes, such as increase in the amount of fibrous tissue, and atypical architecture of the mammary tissue itself. These changes, however, must be considered as part and parcel of this condition, and, *per se*, do not justify the microscopical diagnosis of neoplasm. A tumor could hardly make a male breast mimic so perfectly a female.

FRACTURE OF THE SESAMOID BONES OF THE THUMB

DR. PENN G. SKILLERN, JR., read a paper with the above title, for which see page 297.

LOCAL DIPHTHEROID WOUND INFECTION

DR. ARTHUR E. BILLINGS (by invitation) read a paper with the above title, for which see page 343.

DR. J. STEWART RODMAN related the history of a little girl operated on three years ago at the Medico-Chirurgical Hospital for appendicitis with abscess. The wound was allowed to remain open for drainage. When drainage had about ceased and when the granulating wound was perfectly healthy, a diphtheria epidemic broke out in the children's ward. Several days after the outbreak of this epidemic a grayish

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membrane appeared on the granulations in the wound, which kept re-forming in spite of being stripped off when the wound was dressed. Finally it occurred to some one that it would be well to have a bacteriological examination made, and there proved to be a local infection of the wound with diphtheritic infection. The child was removed to the Municipal Hospital, made a complete recovery and was subsequently operated on for ventral hernia.

ARTHROPLASTY OF THE ELBOW; WITH A REPORT OF FIVE CASES

DR. ASTLEY P. C. ASHHURST read a paper with the above title, for which see page 302.

DR. GWILYM G. DAVIS said that the results obtained by Dr. Ashhurst show that arthroplasty in this joint is more satisfactory than in most others. This accorded with his own experience. It would seem, therefore, that surgeons are justified in carrying out more radical procedures in cases with limitation of motion in the elbow than in joints of the lower extremities in which weight-bearing tends to detract from the good results. The question arises of the necessity of retaining the lateral ligaments. In the majority of his own cases he had not retained these ligaments. Instead of making one large flap he had made two, taking one flap from each side. One of the difficulties of the operation is shown in one of his cases in which there was some trouble with the vitality of the flap. This is a serious difficulty in arthroplastics, especially of the knee. The necessity of using in the arm flaps from other parts of the body, like the fascia lata, is not so urgent as in the knee and hip. While very fair results can be obtained by ordinary resection, this resection without the interposition of flaps necessitates the removal of one to one and a half inches of bone to insure movement. When an arthroplasty is done only sufficient bone to allow interposition of the flaps needs to be removed, and this is less than half the amount necessarily removed in an ordinary resection. The arthroplasty, even without the retention of lateral ligaments, if there is no mishap, is almost certain to give a stable joint.

THE OPERATIVE TREATMENT OF FRACTURES OF THE FEMUR, HUMERUS, AND TIBIA

DR. GEORGE P. MÜLLER presented lantern slides illustrating his subject.

REVIEW OF A SERIES OF FRACTURES

DR. WILLIAM J. RYAN (by invitation) read a paper with the above title, for which see page 293.

BOOK REVIEWS

MODERN SURGERY. By JOHN CHALMERS DA COSTA, M.D., LL.D.
Philadelphia: W. B. Saunders Company, 1914.

This is the seventh edition of this book. It is a volume of some 1500 pages and more than 1000 illustrations. It shows real revision, as notable changes and additions have been made. In a former review in the *ANNALS OF SURGERY* it was stated that the book had a place in surgical literature; it still has, and it fills the place well. This new revision brings it up to date, as well as is possible in these times of constant change. It is a practical and useful book. It has packed into it as much of the science and art of surgery as can well be put into one volume.

There are some features which might attract unfavorable criticism. The views of others are much quoted in matters concerning which the opinion of Dr. Da Costa would have quite as much weight and would be more appropriate. There is a disposition on the part of some writers to present the opinions of others for the purpose of emphasizing what is trite and commonplace, although neither information nor authority are added above what they themselves might contribute.

There is much proper-name nomenclature. Most of it is quite unjustifiable. "Hilton's method" may mean something to Dr. Da Costa, but not to most of us. The method is a good one; and Hilton undoubtedly was an estimable surgeon, for he said "to plunge in a knife is not courageous, as it is without danger to the surgeon, but may be fatal to the patient;" but his method of opening abscesses had been employed by many surgeons before him.

The description of treatment of some surgical conditions seems very meager. This is the case in the chapter on club-foot. But no work like this could be expected to contain full information on every subject.

The excellencies of this book so preponderate over the deficiencies that a reviewer is compelled to yield it praise. It is practical, and a valuable working help for the practitioner of surgery.

JAMES P. WARBASSE.

BOOK REVIEWS

CYSTOSCOPY AND URETHROSCOPY for General Practitioners, by BRANSFORD LEWIS, Professor of Genito-Urinary Surgery, Medical Department of St. Louis University, and ERNEST G. MARK, Professor of Genito-Urinary and Venereal Diseases in the University Medical College, Kansas City, with a chapter by WILLIAM F. BRAASCH, Attending Physician to the Mayo Clinic, Rochester, Minnesota. P. Blakiston's Son & Co., Philadelphia, 1915.

Doctor Lewis' position as Professor of Genito-Urinary Surgery in the Medical Department of St. Louis University, coupled with his great clinical experience, is certainly sufficient guarantee of the excellence of any work which may be published under his name. He is not only a teacher but a pioneer in the development of urology. Many and important have been his contributions to this department of surgery and his work has been a source of inspiration to numerous pupils who have gone forth to render a good account of their stewardship. In the present work his collaborators are Ernest G. Mark of Kansas City, than whom perhaps no other American has made a more complete study of urethroscopy, and William F. Braasch of the Mayo Clinic, who has done so much to perfect uretero-pyelography.

In a brief chapter on the anatomy of the bladder, the authors have adopted the suggestion of Pedersen, that the bladder be divided into four segments or quadrants, which plan is very convenient for purposes of systematic study and recording. It is noteworthy that the word *fundus*, which has been the cause of so much confusion in surgical literature, has been omitted.

Twelve pages are employed in an exceedingly entertaining and accurate historical review of cystoscopy, the development of instruments and technic being traced from the time of Bozzini of Frankfort, who in 1806 presented his "Lichtleiter." The labors of Desormeaux, Brück, Grünfeld and the immortal Nitze, leading up to the development of an instrument which made cystoscopy practicable, are described in some detail, while certain important modifications made by Newman, Boisseau du Rocher, Brenner, Albarran, Valentine, Tilden Brown, Bierhoff and others receive due consideration. One notes several eminently practical paragraphs in the chapter on cystoscopic technic; for instance, the authors remark: "It is thoroughly impracticable to describe in its great variations of shape, elevation and vascularity, a 'normal' or 'typical' trigonum. A recognition of these variations within normal limits must result from thorough training in practical cystoscopy."

BOOK REVIEWS

Ureteral catheterism by the direct, indirect and the Pawlik-Kelly methods is described in detail and the various functional tests are discussed at length. Full credit is given to Rowntree and Geraghty for their contributions on phenolsulphonephthalein. Of cryoscopy it is remarked that even Rumpel, Kümme's most enthusiastic assistant, suggests that its use should be combined with chromocystoscopy and the phloridzin test in order that accurate deductions may be made. In discussing chromocystoscopy, indigo-carmin is mentioned as being administered by intramuscular injection. This is somewhat at variance with the teaching of most surgeons, the preference being given to the intravenous injection of 10 c.c. of a 3/10 of 1 per cent. solution.

The chapter on uretero-pyelography is concise and the indications for the procedure are clearly defined. The authors state that in a series of over one thousand cases the method has been employed by them with neither fatality nor permanent injury, but no mention is made of the fact that several deaths resulting from pyelography, in the hands of experts, are on record.

The history, armamentarium and technic of operative cystoscopy occupy thirty-three pages. Intravesical cauterization of tumors according to the technic of Beer, which has done so much to reduce the mortality in this formidable class of cases, is given a prominent place.

The chapters on the development of the urethroscope, technic for its employment and operative urethroscopy are well written and generously illustrated. This portion of the work will be greatly appreciated by those whose privilege it was to work with the late Doctor Valentine, for he was not only among the first to introduce the methods of such men as Oberländer, Kollmann and Wossidlo to the American Profession, but labored for years to popularize them. The authors give to Valentine the credit for having devised with the help of Mr. Preston, an electrician of Rochester, the first low amperage lamp. The assertion that it is inadvisable to urethroscope the posterior urethra unless such a procedure is deemed absolutely essential, is greatly to be commended. They consider air inflation as practically indispensable in operative urethroscopy, but their warning against the danger of emphysema and air embolus is emphatic.

BURTON HARRIS.

CORRESPONDENCE

POST-OPERATIVE BACKACHE

EDITOR ANNALS OF SURGERY:

Recently my attention has been called with considerable frequency to the persistent backache that has followed operations upon patients who have been placed in the Trendelenburg, dorsal or dorso-vaginal position.

The condition described by the patient is that the backache has been present from the time of the operation and that remedies have been without avail. The back is tender to pressure. Hyperextension relieves the pain.

Treatment for a slipping sacro-iliac joint, enteroptosis, pronated feet, etc., is without result, and the trouble gradually disappears in the course of time or while the patient is under the osteopathic or some other cult.

Lack of support to the lumbar curve while the patient is on the operating table has been mentioned as a cause of backache, and it is not difficult to appreciate that the observation is seemingly correct; if one will lie flat on his back on an operating table for any length of time, some idea of the trouble produced will be experienced.

The following is what occurs when an operation is performed with the patient in the dorsoperineal position. The subject is placed on the flat operating table and drawn down sufficiently to enable placing the feet in the stirrups, then the buttocks are drawn down between the uprights so that they are almost on a plane with the heels. For a good exposure the buttocks are drawn down even beyond this plane.

When this has been done the thighs are hyperabducted and are flexed in the position of hyperabduction. The strain on the back is great and is exaggerated because of the flattening of the lumbar curve. As above stated, the unsupported lumbar curve with the patient in the dorsal decubitus on the table is a potential cause of back strain.

The strain on the back under these conditions to the sacral and hip ligaments must be at times quite severe, and it has been the experience that this form of trauma is slow to respond to treatment. The damage done to the brain-cells through the noci ceptors of Crile, even though the patient is under the anæsthetic, cannot be recognized, and it

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is probably here that the greatest harm is done. I believe firmly as Crile advocates in this kind of injury and that a "brain scar" is produced.

If the above-described recumbent posture produces a trauma of the brain-cells, what physical local damage must be inflicted on the ligaments and articulations of the back of the patient in a dorsal position with the feet in stirrups and the thighs in flexed hyperabduction and the buttocks drawn down to the end of the table between the uprights.

The Trendelenburg position is, in my opinion, also a potential cause of backache.

In this position the lumbar curve is exaggerated because the thighs are in the position of slight hyperextension which produces a very severe strain on the ligaments of the back. To me it is a matter of surprise that more damage is not inflicted. Since this subject has been considered, I have been observing what is done to the unconscious patient on the operating table concerning position, and the trauma inflicted must be at times severe. By care a considerable percentage of backache, in my opinion, as a post-operative feature, may be avoided, and the following suggestions are offered:

Prophylaxis: 1. The lumbar curve should be supported by a sand-bag or pillow of the proper size.

2. The stirrups and uprights should be discarded and replaced by the old-fashioned Clover crutch which will bring the thighs into flexion without abduction, for all of the vaginal and rectal operations can be performed without any abduction.

3. In the Trendelenburg position the lumbar curve should be supported and pillows should be placed under the thighs to avoid hyperextension of the back and thighs.

CHARLES G. LEVISON.

San Francisco, Cal.

RUPTURE OF BICEPS FLEXOR CUBITI

TO THE EDITOR OF THE ANNALS OF SURGERY:

While reading the article by Dr. Alexander in the ANNALS OF SURGERY for May, 1915, on Rupture of the Biceps Flexor Cubiti, I was reminded of a couple of articles which I wrote upon this subject many years ago. These seem to have been omitted from the bibliography which was attached to Dr. Alexander's article. Permit me to add them now in order to complete his bibliography. They are as follows:

Rupture of the Tendon of the Long Head of the Biceps. (With

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illustration showing Dissecting-room Specimen.) *Boston Medical and Surgical Journal*, January 17, 1889, p. 61.

Rupture of the Tendon of the Long Head of the Biceps Brachii Muscle. (With four cases and two illustrations.) *Boston Medical and Surgical Journal*, November 25, 1886, p. 496.

GEORGE H. MONKS.

Boston, Mass.

THE UTILITY OF THE FATTY CAPSULE IN THE OPERATION OF NEPHROPEXY

TO THE EDITOR OF THE ANNALS OF SURGERY:

It seems to be customary to regard the fatty capsule of the kidney as useless in the operation of fixation of the viscus, so that in most text-books on operative surgery it is advised to strip it off and remove it before the process of fixation. For some time past, however, I have been in the habit of turning it to considerable mechanical advantage. Instead of taking it away, it is stripped downward and packed into the cavity which is always left below the lower pole of the viscus after the latter has been raised and fixed. Thus transposed and secured by a stitch which unites it to the visceral and parietal peritoneum, this collection of fibro-fatty material assists in forming a shelf upon which the kidney can rest and thereby relieve the strain upon those stitches that have been passed through the true capsule to secure the kidney to the abdominal parietes.

Prior to the adoption of this method some iodoform gauze was packed into the vacant space, as illustrated in my book on "Practice and Problem in Abdominal Surgery," where what I have termed the "sling" method is fully described. The replacement of this artificial packing by living organic tissue allows the wound to be completely closed.

A. ERNEST MAYLARD.

Glasgow, Scotland.

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